ENGINEERING LITERATURE

Supplement to ENGINEERING NEWS. 220 Broadway, New York, March 18, 1909.

CONTENTS.

EDITORIAL 25
A Reviewer's Discovery of a New Sewage Distributor —A Contemporary Literary Pen Picture of the Introduction of Macadamized Roads in England.

CORRESPONDENCE:
Comments on Review of Australasian Roads; J. M. and H. E. Coane 25

REVIEWS:
Water Power Engineering (illustrated). Reviewed by F. C. Finkle 25
Artificial and Natural Flight.—Etude sur l'Aviation. 27
An Elementary Manual of Radiotelegraphy and Radiotelephony 27
The Life Story of the Right Hon. John Burns, P. C., M. P. 28
Three Bulletins on Fuels 28
Cement Pipe and Tile 29
The Economy Factor in Steam-Power Plants—Heat Energy and Fuels—Anleitung zur Durchführung von Versuchen an Dampfmaschinen und Dampfkesseln. Reviewed by Lionel S. Marks 29
Mechanics of Engineering 30
Handbuch des Materialprüfungswesens für Maschinen- und Bauingenieure 30
Artificial Waterways and Commercial Development 30
Problems of City Government 31
Ex-Meridian Altitude, Azimuth and Star-Finding Tables 31
Nautical Charts 31
The Steam Turbine. Reviewed by A. G. Christie. 32
Railroad Signal Dictionary 32
Modern Methods of Sewage Disposal 32
Guide to Sanitary Inspections 32
Applied Mechanics for Engineers. Reviewed by Alfred H. Knight 33
Neue Versuche an Eisenbeton-Balken über die Lage und das Wandern der Nullinie und die Verbiegung der Querschnitte Versuche über Reine Haftfestigkeit—Entwurf eines Wasserkraftwerkes im Gebiet der Murg Oberhalb Forbach—Di: Portland-Zement-Fabrikation 33
The Mechanical Appliances of the Chemical and Metallurgical Industries 33
General Lectures on Electrical Engineering 34
Water and Sewage Purification Plants in Ohio 34
The Portland Cement Industry from a Financial Standpoint 34
Brennan's Handbook 34
Law and Business of Engineering and Contracting 34
The Interpretation of Topographic Maps 34
American Railway Transportation 35
Report on the Indeterminate Franchise for Public Utilities 35
Illustrated Technical Dictionary 36
Industrial-Social Education 36

PUBLICATIONS RECEIVED 37

EDITORIAL

A reviewer of a recent American book on sewage treatment appears to be surprised because he did not find in the book "any description of the aphidian distributor in common use in England." Certainly the omission is surprising and unfortunate. If such distributors are, as the reviewer states, "in common use in England," we see no reason whatever why the entomologists of this country should not be set at once to training our own myriads of aphides to the task of sewage distribution, thus converting a pest into a blessing. This done, we should look for an establishment of sewage farming here on as extensive a scale as was ever practiced in the palmiest days of that art in England. The most promising line of development would seem to be fruit plantations. Here the aphides required for distributing the sewage would be grown on the trees, and the time and strength which they would have to devote to distributing the sewage would perhaps be sufficient to so diminish their voraciousness as to give the trees a fair chance of healthful growth. Any sapping of the energy of the trees would be made up by the fertilizing value of the sewage and by preventing injury to the trees through drought. Before any of our readers launch any ventures in accordance with the possibility just outlined, we would suggest that they make sure whether this aphidian distributor was not evolved in the brain of some stenographer, who misunderstood the reviewer when he dictated the word "Fiddian," which is the trade name of one of the many British sewage distributors. There is just a possibility that this was really what the reviewer had in mind, and that by some chance he failed to revise his typewritten "copy" and did not see proof of his review before it was printed.

An interesting pen picture of the introduction of macadamized roads in a rural district of England, with glimpses of a remarkably genial and self-sacrificing surveyor, has given the editor so much pleasure during several readings and rereadings that he ventures to reprint it here for the benefit of those who may not have seen it in its original setting. The picture is taken from "Our Village," a series of charming essays on rural life, scenery and character, by Mary Russell Mitford, which appeared at intervals from 1819 to 1832. The first complete edition of these essays appeared in 1843. We quote from one of the handy volumes in the (Dent and Macmillan) "Temple Classics." For the better understanding of the opening sentence it may be stated that this pen sketch appears in an essay called "A Parting Glance at Our Village." The author says:

The only real improvement with which we have been visited for our sins—(I hate all innovations, whether for better or worse, as if I was a furious Tory, or a woman of threescore and ten)—the only misfortune of that sort which has befallen us in under foot. The road has been adjusted on the plan of Mr. Macadam; and a tremendous operation it is. I do not know what good may ensue; but for the last six months some part or other of the highway has been impassable for any feet, except such as are shod by the blacksmith; and even the four-footed people who wear iron shoes make wry faces, poor things! at those stones, enemies to man and beast. However, the business is nearly done now; we are covered with sharp flints every inch of us, except a "bad step" up the hill, which, indeed, looks like a bit cut out of the deserts of Arabia, fitter for camels and caravans than for Christian horses and coaches; a point which, in spite of my dislike of alteration, I was forced to acknowledge to our surveyor, a portly gentleman, who, in a smart gig, drawn by a prancing steed, was kicking up a prodigious dust at that very moment. He and I ought to be great enemies; for, besides the Macadamite enormity of the stony road, he hath actually been guilty of tree murder, having been accessory before the fact in the death of three limes along the rope-walk—dear, sweet, innocent limes, that did no harm on earth except shading the path! I never should have forgiven that offense, had not their removal, by opening a beautiful view from the village up the hill, reconciled even my tree-loving eye to their abstraction. And, to say the truth, though we have had twenty little squabbles, there is no bearing malice with our surveyor; he is so civil and good-humored, has such a bustling and happy self-importance, such an honest earnestness in his vocation (which is gratuitous, by-the-bye), and such an intense conviction that the state of the turnpike road between B. and K. is the principal affair of this life, that I would not undeceive him for the world. How often have I seen him in a cold winter morning, with a face all frost and business, great-coated up to the eyes, driving from post to post, from one gang of laborers to another, praising, scolding, ordering, cheered, laughed at, and liked by them all! Well, when once the hill is finished, we shall have done with him forever, as he used to tell me by way of consolation, when I shook my head at him, as he went jolting along over his dear new roads, at the imminent risk of his springs and his bones; we shall see no more of him; for the Macadam ways are warranted not to wear out. So be it; I never wish to see a road-mender again.

The curious may like to know that "Our Village" was Three Mile Cross, between Reading and Basingstroke. Here Miss Mitford took up her residence in 1820. Presumably, but we are not at all sure, this essay was written shortly after that date.

CORRESPONDENCE.

Comments on Review of "Australasian Roads."

Sir: In the notice of "Australasian Roads," appearing in your issue of Oct. 15, 1908, your reviewer makes it appear that drivers of four and six-horse teams can command in Australasia 75 cts. and $1.05 per hr., respectively. Lest this, appearing in your widely-read paper, should mislead, we desire respectively to point out that these sums include the provision of horses and harness, as well as drivers' wages, as will appear from a perusal of the table as printed in the book; at any rate the context would make this clear to any one who read the chapter. In quoting this table, your reviewer has altered it: had he not done so, we would have trusted to the intelligence of your American teamsters, and would not have troubled you with this communication.

Yours faithfully,
J. M. and H. E. Coane.

70 Queen St., Melbourne, Jan. 14, 1909.

[The foregoing letter having been submitted to Mr. Samuel Whinery, M. Am. Soc. C. E., author of the review in question, Mr. Whinery states that the figures in question were based on statements made in brief tabular and text matter. The only reference to rate of wages in the text is the following sentence: "Wages for various classes of labor have been allowed for as scheduled in Table VI." Mr. Whinery comments on the use of the word "with" in the last four entries in the table, as follows:

The use of "with" in the sense in which the authors evidently intended, is unusual in this country and I assumed it to be equivalent to "in connection with." Had "and" been used by the authors in place of "with," the meaning would have been obvious. The customary phrase here would be "Four-horse team and driver," etc.

The table mentioned is reproduced herewith.

AVERAGE AUSTRALASIAN RATES OF WAGES, SUBJECT TO MODIFICATIONS ACCORDING TO LOCALITY AND CONDITIONS.

Class of labor.	Wages per day of eight hours.	Wages per hour.
Laborer, scavenger, and sweeper	7/-	-/10-1/2
Foreman laborer	7/6	-/11-1/4
Pitcher setter	9/-	1/1-1/2
Carpenter	10/-	1/3
Steam roller driver	10/-	1/3
Driver laborer, with horse in cart, watercart, scraper or sweeping machine	11/-	1/4-1/2
Driver laborer, with two horses in wagon, watercart, roller or scoop	15/-	1/10-1/2
Driver laborer, with four horses in wagon, roller, road machine or other implement	25/-	3/1-1/2
Driver laborer, with six horses in roller, road machine or other implement	35/-	4/4-1/2

The wage figures given in the table indicate shillings and pence: about 25 cts. to the shilling and 2 cts. to the penny.—Ed.]

REVIEWS.

The Water-Power End of Hydro-Electric Engineering.

Reviewed by F. C. FINKLE.*

WATER POWER ENGINEERING.—The Theory, Investigation and Development of Water Powers. By Daniel W. Mead, M. Am. Soc. C. E., Consulting Engineer, Professor of Hydraulic and Sanitary Engineering, University of Wisconsin. New York: McGraw Publishing Co. Cloth; 6 x 9¼ ins.; pp. 787; 413 illustrations, mostly in the text, and 89 tables. $6.

The above-named work is devoted to the theory and practice of developing water-powers. While it is designated as a general treatise on the subject, the text is limited to a consideration of water-power developed in connection with electric plants. This branch of water-power development is somewhat different from that under which the hydraulic power is applied directly to industrial machinery. It involves the infinite considerations arising from the conversion of the hydraulic into electrical energy, and its distribution throughout extensive districts for manifold uses. It has become known in the technical world as Part I. of Hydro-Electric Engineering.

The book opens with a chapter on the history of appliances for utilizing the potential energy of water, which carries the chain of progress in this branch up to the invention of the reaction turbine. As the range of usefulness of the reaction turbine is limited to a certain set of conditions, the story might properly have been completed by adding the narrative of how the impulse turbine, which fits the other set of conditions, was invented and successively perfected. The next chapter is a very good presentation of the physics of energy, with a statement of the re-

*Consulting Engineer, 230-231 I. W. Hellman Bldg., Los Angeles, Cal.

lations between the conventional units adopted for the measurement of energy.

Chapter III. treats of the hydraulics of canals, pipes, weirs and some kinds of orifices. The treatment is incomplete, as it does not include the laws governing the effect of bends, curves, gates, changes of section, etc., in canals and pipes. Nor does it include any analysis of the rules governing the flow through nozzles, Ys, branches in main canals and pipes, etc. A still more important omission is the failure to discuss the relation of hydraulics to the materials of which canals and pipes may be constructed. This is one of the most important phases of hydraulics, as it is incumbent on the engineer to select such materials for use in constructing conduits as will withstand the velocity and other destructive attributes of the water to be carried by them. In presenting the formulas of flow in such a work one should be careful to discriminate by giving the derivation and applicability of each to various conditions. Either this is necessary, or only one formula should be given, in order not to confuse the student and young engineer. Sufficient is said in the book to distinguish between the use of Kutter's and Bazin's formulas for flow in open channels, but this is not true regarding the nine formulas for flow in pipes, given in Fig. 25. The reviewer believes in an exponential formula like that of Tutton, but does not ignore the fact that some others of more involved structure give nearly as close results. Nevertheless it must be asserted that some formulas, like that of Sullivan,* are unsound theoretically and give results at variance with experimental data.

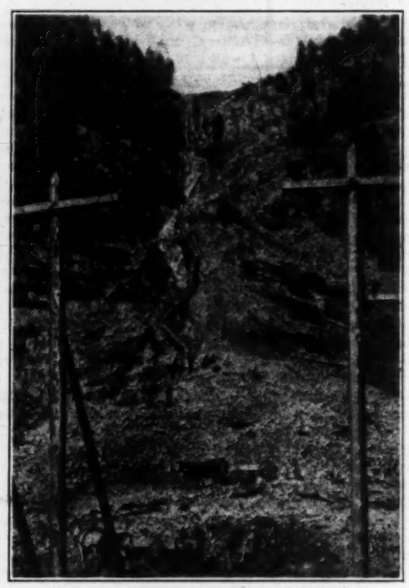
Chapters IV. and V. are to be highly commended for the comprehensive manner in which the power available from streams is treated. The use of hydrographs for solving these classes of problems has long been employed by the reviewer in his practice, and he can heartily commend this method to his co-laborers in the profession. At the same time it must be understood that the term "hydrograph" is a very general expression, and should not be used in the text, as is done in Articles 49 to 54 of this book, without some qualifying adjective, as for example "discharge hydrograph," "storage hydrograph," "rating hydrograph," etc.

Chapters VI. to XI., inclusive, should have preceded Chapters IV. and V. for the sake of logical arrangement. It would seem that the rules for ascertaining the flow of streams should precede those relating to stream hydrographs and stream-power diagrams, since the latter are based on stream discharges, whether these are from actual gagings or derived from other indirect data by interpolation. As remarked by the author himself, on page 82, "it is rare that observations of stream flow for a long period of years are available at the immediate site of the proposed power plant." Hence the necessity for acquainting the student with the methods by which stream flows may be approximated from rainfall, run-off on similar drainage areas, geological examinations, ratios obtained from fragmentary data, etc., before he proceeds to construct hydrographs and power diagrams.

Barring this defect in arrangement all of these chapters are very good. Attention may be called, however, to the statements regarding "the water year" in Articles 77 and 90. It is there stated that "December to May is termed the 'Storage' period, June, July and August constitute the 'Growing' period, and September, October and November the 'Replenishing' period." This statement is general, but such is not the fact in all parts of the United States. It is only true in sections, where the climate is similar to that of the North Atlantic and Middle Western states. It does not apply in the Rocky Mountain region, because precipitation in sufficient quantity to cause replenishment and stroage cannot be relied on until January, and the year should be divided into two periods, "storage" from January to May and "draft" from May to January, during which period the main supply of water is from previous natural storage, which is but slightly augmented by precipitation.

In the greater part of the Southern states no periods can be designated as the "water year," except on streams rising in the North and flowing through the South, as the precipitation occurs in the form of pretty evenly distributed rainfall. In the Pacific Northwest the period from November to June may be termed "storage" and from July to October "draft," while in California these two periods are from December to March "storage" and April to November "draft."

With Chapter XII., which is a good history of turbine development in the United States, the author begins the second part of his work: that is, the exposition of principles relating to the design and construction of power plants on streams. The chapter following this deals in a very satisfactory manner with many important details of turbine design, such as bearings and



Wrecked Force Main of Animas Power and Water Co., of Durango, Colo.

(The break was caused in September, 1906, by water hammer due to the action of the by-pass needle nozzle under short circuits from transmission line.)

regulating gates. Other matters of detail are merely mentioned, as for instance draft tubes, for which no information regarding proper length, diameter and taper is given.

Chapter XIV., it seems to the reviewer, gives but partially and imperfectly the theory of turbine hydraulics. This the author admits in Article 148, wherein he states:

> It is not the purpose of this chapter to consider mathematically and at length the principles of hydraulic flow in relation to the curves of guides and buckets and the effects of such curves on the power and efficiency of the turbine.

Figs. 203, 204 and 207 are so incomplete and imperfectly drawn, that they are of little value as an aid to understanding the text and grasping the principles involved in turbine hydraulics. The whole chapter is principally valuable for instructing an engineer how to work from some established and tested standard and for making comparisons between different types of American turbines. It neither furnishes any guide for independent designing nor imparts any knowledge from which it may be determined why certain efficiencies result when testing turbines.

Chapter XV. gives in detail and very clearly and concisely the methods employed for testing turbines to determine their efficiency and other characteristics. Following in the next chapter is a discussion on the selection of a turbine for any particular case. Viewed from the standpoint of securing something about as good as that possessed by one's predecessors, the analysis given is a good one. B[illegible] considering the many defects and inconsisten[cies] found in a great majority of the turbines [in use, it] is to be questioned whether such [rule is the] proper one to follow.

It is an undisputed fact that t[he design of] hydraulic turbines in this count[ry has been] largely by the "cut and try" met[hod, one de]signer blindly following his for[mer and] adopting such changes only as re[sulted trials] have demonstrated to be advisable. [This prac]tice should be discouraged by eng[ineers as it] is seldom that two conditions are [alike] to warrant copying. European en[gineers and] many American engineers as well ha[ve long since] recognized this to be true, and h[ave applied] scientific principles to their designi[ng. A cor]rect mathematical solution of the p[roblems in]volved is the only safeguard against [failures in] hydraulic-turbine installations. T[he turbine] must be considered as a part of one [mechanical] unit, the power plant, and especially [designed to] fit all the conditions of the whole. When all these conditions and factors are known and understood by the engineer, he can by careful mathematical analysis determine in advance of ordering a turbine what should be its speed, the form of guides, nozzles, buckets and draft tubes, the materials of which each part is made, etc. This, it is true, leads to very complicated and long equations in mathematics or to intricate and almost endless graphical solutions.

However, it is better to undertake such a careful and searching investigation *a priori*, than to have the imperfections, failures and renewals which so often accompany attempts to solve the same problems by copying something else, or by the "cut and try" process. Were it necessary to strengthen this argument by practical illustrations, this could be done by citing numerous examples of plants where such hydraulic turbines have been replaced and are being replaced almost as soon as the beginning of operation.

Chapter XVII. treats of a very important matter relating to power plants, namely the load factor, and the information and suggestions given are all good and timely. It is to be regretted that this is a matter about which engineers are seldom consulted by power-plant managers, although it is strictly an engineering problem.

In Chapter XVIII., taken in connection with Appendices A, B, and C, are found some of the most valuable data in the volume, as they bear on the subject of regulating hydraulic turbines, which subject has been less perfectly understood by engineers than any other part of hydro-electric engineering. While commending the manner in which the subject has been treated the following remarks may be pertinent: From experience with air chambers the reviewer believes that they are of much value in preventing the rupture of penstocks and long force mains, whose factor of safety is not high enough to withstand the full impact of severe water hammers. But it is not demonstratable that they are of any material assistance in securing good regulation, and the surge tank of Dr. Raymond D. Johnson, which is merely a greater air chamber, cannot be expected to produce that result. The regulation of tangential impulse plants, having long force mains, is most satisfactorily accomplished by deflecting the nozzle, and having a supplemental and slower regulating device for changing the position of the needle valve in the nozzle.* Only in this way can the danger incident to surges and oscillatory waves in the force main be avoided and a saving of water affected at the same time. The use of the stationary by-pass nozzle for such cases is dangerous, as under the action of swinging short circuits on the transmission line the rapid alternations of needle movement and consequent reversal of flow through the two opposing nozzles has a tendency to so multiply the frequency of water-hammer pressure waves as to cause harmony with the vibration period of the pipe and thus create a destructive accumulation of pressures. This is what happened to the plant of the Animas Water & Power Co.,

*Engineer and Contractor, San Francisco, Vol. III, No. 2, pp. 10 and 11, and Vol. III, No. 3, p. 20.

near Dura[illegible], Colo., in September, 1906, when the force [illegible]n was destroyed by water hammer. (See repr[illegible]tion of photograph herewith.)

Equation 41 $$\left(\delta = 294{,}000 \frac{R \times \Delta K}{I S^2}\right)$$

and

42 $$\left(I = 294{,}000 \frac{R \times \Delta K}{\delta S^2}\right)$$

given on page 463, are undoubtedly sound mathematically, but the difficulty in estimating the value of R makes them of doubtful practical value. The following equations given by the reviewer* are easier to apply:

$$\delta = 800{,}000 \frac{N T}{r^2 \Sigma W R^2}$$

and

$$\Sigma W R^2 = 800{,}000 \frac{N T}{\delta r^2}$$

in the case of reaction turbine plants with water-saving by-pass, the value of T being fixed by the calculated time required for accelerating the water in the force main. (Note that with the exception of δ the characters in the two sets of equations are different.)

In order to protect themselves, even when engineers do not protect their customers, manufacturers of water-wheel governors should insist on the kind of specifications recommended in Art. 231 of Prof. Mead's book.

Chapters XIX. to XXII., inclusive, dealing with safety devices, construction details and illustrations of constructed plants, are interesting and instructive. All safety relief devices, however, should be fully explained to students and understood by engineers, as an understanding of the mechanics of such devices is necessary to their proper and safe use. Likewise great flexibility should attach to all directions regarding the arrangement of the turbine units in a station, since special conditions encountered in each individual case require departure from any fixed rule. Foundations should be of masonry or concrete for all permanent plants, unless the excavations are in bed rock, which will hold anchor rods. The water-power plants cited as examples are mostly of the reaction-turbine type with low hydraulic heads, but the references to literature at the end of the chapter cover all possible conditions.

Chapters XXIII., XXIV. and XXV., if considered by themselves, are far too brief for the importance of the subjects treated. Of course the literature cited covers the subjects of head races, dams and appendages for dams, but it requires time to consult so much scattered information, and for engineers and students located in small and remote communities the literature cited is seldom available. It may be questioned if a work of this kind should not contain more data relating to head races or feeder conduits, particularly in this day when water must be carried for long distances to make a fall available, and also in regard to dams, in the design and construction of which much advance has taken place recently.

The chapter on pondage and storage is far too incomplete. There should be a sharp distinction made between storage and regulating reservoirs, the former being intended to equalize the stream flow and the latter to accommodate the plant load factor and supply water during breaks in the feeder conduit.

In irrigated sections both primary and secondary reservoirs are often necessary to avoid conflicts with irrigation rights, and this is a very important matter in many localities.† The question of storage also involves many considerations arising from the daily, monthly, yearly and secular fluctuations of streams and the load curve, both present and future, of the proposed water-power plant. These can best be solved graphically by the construction of hydrographs to show the results of storage and draft with the reservoir capacities available and the demands on the power plant. Such compilations as those given in Table XXXIX. may form a part of the chain of figures from which hydrographs can be constructed, but should never be considered the final form for presentation in a report or its appendix.

The author's suggestion that a report be brief, stating only the necessary information and conclusions concisely, and that all explanatory matter, maps, profiles, tabulations, hydrographs, etc., should be submitted in an appendix, will be concurred in by engineers as well as capitalists. This arrangement results in a saving of time to busy men who have occasion to examine a report. In making reports on power projects it should also be remembered that the cost per horse power of capacity in the plant is not so important as it once was. This used to be the criterion when power was sold on a flat-rate basis, but with the general use of meters a different condition has arisen. The true test of the commercial value of a water-power plant is now what it can deliver kilowatt hours to the customers for, their load curve being considered. Thus a plant's flexibility in supplying power, its annual depreciation, cost of maintenance and reliability without auxiliary power plants are more important than the mere fact that its cost of construction is a fixed amount per horse power or kilowatt of capacity at 100% load factor. The reviewer believes that only the third method given on page 672 is the correct one for computing the value of an hydro-electric plant. The first seems impossible of application, owing to the difficulty of placing a value on water rights, and the second is unreliable because the earnings of a property are often affected by adverse temporary circumstances, while a comparison with the best possible competitor can always be made, if the facts are carefully and impartially considered.

In addition to the things considered important in a report, as stated by the author on pp. 683 and 684, the following may be added:

(1) Cost of power per KW.-hr. from proposed plant delivered to probable consumers.

(2) Cost of power per KW.-hr. from other plants, existing or possible, delivered to the same consumers.

(3) A description of the works proposed to be constructed sufficiently complete to permit the determination of probable depreciation on the plant.

(4) A careful estimate of all annual fixed charges.

Space prevents discussion of many other matters scarcely less important, but in conclusion it is proper to acknowledge the value of Prof. Mead's work by saying that his book should be found in the library of every hydraulic engineer; that it is a valuable work of reference for engineers generally; and that students of water-power engineering can profit by its liberal use in their course of study.

*See Engineering News, Vol. 60, No. 26, Dec. 24, 1908, p. 710.

†Trans. Am. Soc. C. E., Vol. XXXIV., + No. 7, pp. 1,028 to 1,035. Irrigation, an Informal Discussion at Annual Convention Am. Soc. C. E., June 25, 1908.

Aerial Navigation.

ARTIFICIAL AND NATURAL FLIGHT.—By Sir Hiram S. Maxim. London and New York: Whittaker & Co. Cloth; 5½ x 8¾ ins.; pp. xv. + 166;; 95 illustrations in the text. $1.75, net.

This book is essentially Sir Hiram Maxim's views and experiences in the art and science of aerial navigation. The reader will not for long forget that it is Sir Hiram who writes, so manifest is the author's personality. The book is enlivened by passages like the following, taken from Chapter I.:

I do not wish this little work to be considered as a mathematical text book. . . . During the last few years a considerable number of text books have been published. These have, for the most part, been prepared by professional mathematicians who have led themselves to believe that all problems connected with mundane life are susceptible of solution by the use of mathematical formulae, providing, of course, that the number of characters employed are numerous enough. When the Arabic alphabet is not sufficient, they exhaust the Greek also, and it appears that both have to be supplemented sometimes by the use of Chinese characters. As this latter supply is unlimited, it is evidently a move in the right direction.

The introductory chapter deals in a general way with the work of the author and of the other early experimenters. After this part, the flight of birds and kites is discussed and then follows the part really important to students of aeronautics—the account of the author's early experiments with screws and supporting aeroplanes. These are both interesting and instructive and present data that probably have never before been made generally available.

Another interesting and historically valuable part of the book is Appendix II.: a résumé of the early experiments on the famous steam-driven machine which was wrecked in 1894.

The book also contains what the author terms "hints in building flying machines," which are really in the nature of theoretical suggestions rather than tried-out designs. There are a few pages on a gyroscopic regulation of the vertical stability of an aeroplane and very brief descriptions of a few of the latter-day, "heavier-than-air" machines and dirigible balloons.

ETUDE SUR L'AVIATION.—By Maurice de Cantelou. Paris, France: Ch. Béranger. Paper; 6¼ x 10 ins.; pp. 128; 45 illustrations in the text; 6 francs; American price, $1.80.

This book is a scientific discussion and analysis of the mechanical and other principles governing and relating to the art of aviation or flying with machines heavier than air. It contains no descriptions or views of flying machines, but is essentially mathematical and is in consequence full of formulas, diagrams of forces, and similar matter. The author divides the machines of this class as follows: (1) orthopters, or mechanical birds, having moving wings; (2) aeroplanes (with and without motors); (3) helicopters, having screws on vertical shafts to raise and screws on horizontal shafts to propel the machines; (4) machines combining features of the other classes. He describes "aeronautics" as relating to the navigation of the air by means of any kind, but generally restricted to machines lighter than air.

The book then takes up in detail the mechanical principles of the four classes of machines heavier than air, as noted above. It is pointed out, however, that while the figures and formulas can be used on the broad lines of a preliminary design they are more or less tentative. Such investigations must be accompanied by actual experiments. Each class of machine is considered as presenting certain advantages of its own, and it is claimed that all of them can be employed in military work.

Radiotelegraphy and Radiotelephony.

AN ELEMENTARY MANUAL OF RADIOTELEGRAPHY AND RADIOTELEPHONY.—For Students and Operators. By J. A. Fleming, M. Inst. E. El, Pender Professor of Electrical Engineering in the University of London, Professor of Electrical Engineering in University College, London, etc. London, New York and Bombay: Longmans, Green & Co. Cloth; 5¾ x 9 ins.; pp. 340; numerous text illustrations. $2, net.

Prof. Fleming has prepared this book as a preliminary manual, in the study of principles and appartaus, leading to a better appreciation of his larger and more mathematical work, published in 1906. An elementary knowledge of electrical phenomena is presupposed in the reader.

As an easy introduction to electrical wave phenomena, oscillations of current are explained by the analogies of mechanical actions. The properties of electrical circuits—resistance, inductance and capacity, are qualitatively discussed with particular reference to the effect of high potential and high frequency currents.

Apparatuses for the production of electrical oscillations are described in two groups. The first contains all those for generating effects that quickly die out. The second group shows chiefly the generators that have been built for directly producing, from mechanical power, a low-tension current of frequencies up to 80,000 cycles per sec. This part also shows the development of a method of obtaining undamped oscillations of current, of very high frequency, by shunting a direct-current arc by a circuit containing proper capacity and inductance.

One long chapter is interposed on Maxwell's proposition that "the luminiferous ether must be identical with the hypothecated electro-magnetic

medium." This discussion leads up to the formation of a mental picture of the production of Hertz waves through the air, or ether. After this there are outlined the properties of circuits necessary that electrical and magnetic ether waves may be received and radiated. Several notable arrangements of aerial circuits, for the directive production of ether waves, are described and their action is explained by analogies and without mathematics as far as is possible. Chapter VI. describes, in groups, apparatus for the detection of impulses sent out from wireless telegraph circuits.

The book up to this point, some 215 pages, has segregated the matter on generating, radiating and detecting electrical or magnetic disturbances of the ether. In 60 odd pages following Chapter VI., the combinations of these apparatuses into practical radiotelegraphic systems are pictured. The quality of apparatus, the skill of operators and the completeness of organization needed, for successful commercial work, are made evident here. In this section of the book the author pays much attention to Marconi apparatus and stations. The sympathetic treatment of Mr. Marconi's achievements is possibly due in part to the author's association with him in the development of the transatlantic wireless service.

Methods of quantitative determinations of current, voltage, resistance, capacity, inductance, frequency, wave length, etc., are outlined. These methods are, of course, adapted for the high potentials and frequencies and for the long wave lengths prevalent in radiotelegraphy. The final chapter of the book, some 20 pages, takes up radiotelephony—varying the ether disturbances in accordance to the vibrations of articulate speech, receiving such waves on aerial circuits and transforming them to aural vibrations.

John Burns: Labor and Municipal Reformer and Statesman.

THE LIFE STORY OF THE RIGHT HON. JOHN BURNS, P. C., M. P.—By Arthur Page Grubb. London, England: Edwin Dalton. Cloth; 5 × 7¾ ins.; pp. 314; plates. 10s.; American price, $4.

The life of John Burns is of commanding interest to any wide-awake person. It has many special points of interest to engineers, and particularly to municipal and sanitary engineers. Besides many years of devoted and successful work as a citizen in connection with local affairs in the Borough of Battersea, which is a part of Greater London, Mr. Burns did yeoman service for nearly 20 years on the London County Council, and since 1905 he has been President of the Local Government Board. That board, through its control over loans for a large variety of municipal purposes and through its relation to both health and poor-law administration, has a great deal to do with a variety of engineering and other municipal problems. At the present time Mr. Burns has in hand proposed legislation aimed to effect notable reforms in town planning, and it may be presumed that he is giving careful attention to various reforms in handling sewage-disposal matters on the part of the Local Government Board which are involved in the recent recommendations of the Royal Commission on Sewage Disposal (see Eng. News, Oct. 8, 1908, p. 395).

Mr. Burns was born in Battersea in 1858, and, save for short periods, has lived there ever since. From ten to twelve years of age he worked in a candle factory. He then served a short period as a page, after which he became a "rivet-lad in Wilson's Engineering Works." At 14 years of age he had saved money enough to apprentice himself to "the engineering firm of Thorn's." In 1877, when he was 19 years of age, he secured an appointment as "foreman engineer" for the Niger Co., at Akassa, on the delta of the Niger, West Africa. Just what his duties were in this position the book does not make at all clear to the American reader. About a year appears to have been spent in Africa. On returning to England Mr. Burns appears to have continued his work in the engineering trades until his marriage in 1880. Subsequent to this event, he spent some months in Continental Europe studying labor conditions, utilizing the £100 which he had saved in Africa.

Throughout all the period thus far outlined, obviously, the subject of this biography had very little opportunity indeed for obtaining an education, except what he learned in the hard school of experience, and what he gained in self-instruction. He had improved his mind by considerable reading in economic and general literature, and had also gained mental strength and acumen, and attained no little prominence, as a public speaker in the interests of labor.

Inasmuch as the word "engineer" has a very different meaning in England from that given it in America, and since the author of this biography touches very lightly upon the early years of Mr. Burns' life, it is necessary to do some guessing as to what Mr. Burns really did as a workman in his pre-parliamentary years. The clearest picture of this to be found in the book is an extract from some remarks made by Mr. Burns on the occasion of opening the Brighton municipal electricity works in 1906:

> I was the first engineer to make with my own hands the first electric tram-car in this country. That was in 1881, and the croakers were just as bad then as they are now. Electric tram-way traction was then such a novelty that I had to take my governor's dynamo and tram down to the Crystal Palace and run the tram round the grounds for six months before people could be induced to believe that electric traction was possible. So nervous were people that, although the charge was only sixpence, we could not get them to go into the car at all. But bold men are not easily overcome by temporary difficulties like that, so I said to my wife: "You have got to come down to the Palace three times a week and get into the first electric tram-car as a decoy duck for the others." That was only temporarily successful, and so I had to bring along the mother-in-law; and when a husband, a wife and a mother-in-law cooperate, success is ensured.

As the years went on, Mr. Burns gained more and more recognition as a labor leader, by his addresses and his activities outside of working hours. Without ever taking office in Battersea, he was nevertheless instrumental in reforming the government of that district and making the local council overwhelmingly a wage-earners' council and the borough itself a shining example of carrying on municipal works by day labor instead of contract, and also of municipal ownership.

Having become, as he describes himself by a quotation from Shakespeare. "The Standard-Bearer of the Rude Mechanicals," and at the same time having gained an intimate knowledge of municipal affairs in Battersea and elsewhere in London, Mr. Burns naturally became one of the first members of the London County Council on its organization in 1889. Soon after, he was elected to Parliament as a member from Battersea. His services on both the County Council and in Parliament were made possible by a contribution of first £2 per week and later £3 per week for his support, by the Labor League of Battersea.

The splendid services which Mr. Burns rendered to London and to the nation as a member of both the bodies named, combined with his prominence in the great British labor movement in and out of Parliament, resulted in his being elevated to the cabinet as President of the Local Government Board when the Liberal party came into power in 1905. He has the distinction of having been the first so-called "working man" to take a seat in the cabinet, although some years earlier a representative of "labor" became a member of the ministry through an under-secretaryship.

We have not the space at our command to follow in more detail than has been given the life of this remarkable man. But we take pleasure in commending this biography as one which is full of interest from cover to cover.

We wish to call attention to two facts in connection with Mr. Burns' career: (1) The sobering and clarifying effect of a responsible official position upon the would-be reformer; and (2) the very sensible way in which Mr. Burns has gone on, inch by inch, gaining what ground he could for the human interests and the political principles which he so ardently espoused, instead of refusing, as some of his critics try to make out he should have done, to make a little headway now and then, because he could not achieve at a bound all that he desired and sincerely believed the people ought to have.

We cannot refrain, in closing, [illegible] quoting a paragraph which, with some p[illegible]al modifications, pictures graphically an [illegible]ence which the writer of this review had on [illegible] of the most pleasant and instructive half-d[illegible] his life:

> But on the doorstep I hustle again[illegible]ushful American, armed with a letter of introd[illegible] to me from some one I don't know, and he w[illegible] "round up London," from the sociological poin[illegible]view, in the half-hour he has allotted to that ta[illegible]Well, you do your best to oblige him, just taking [illegible] your stride as you go about your morning's work [illegible] by the time the lunch hour has come, and you h[illegible]alked him a vigorous eight miles, he guesses that [illegible] will be quite content to take the rest for grant[illegible] it would be obliged if you would mail him all the [illegible] reports of those subjects that he has not had t[illegible] personally investigate.

Three Bulletins on F[illegible]s.

BULLETINS, U. S. GEOLOGICAL S[illegible]EY—George Otis Smith, Director. Washington, [illegible] Pub. Doc. Paper; 5¼ × 9 ins.

No. 363: Comparative Tests of Run-[illegible]ne and Briquetted Coal on Locomotives. In[illegible]s Torpedo-Boat Tests and Some Foreign Specifi[illegible]ns for Briquetted Fuel. By W. F. M. Goss. [illegible]57; 4 plates and 35 text figures.

No. 366: Tests of Coal and Briqu[illegible]s Fuel for House-Heating Boilers. By D. T. Ry[illegible]ll. Pp. 44; 3 plates and 2 text figures.

No. 365: The Fractionation of Crud[illegible]troleum by Capillary Diffusion. By J. Elliott G[illegible] and Marshall P. Cram, under the supervision o[illegible]avid T. Day. Pp. 33; 3 text illustrations.

The first bulletin contains much general matter on comparisons of run-of-mine and briquetted coals, as well as tabulated and plotted data from a series of locomotive tests made in 1907 at the locomotive testing plant of the Pennsylvania R. R., Altoona, Pa. The arrangement of the plant itself is very briefly shown.

There is a description of the coal-briquet industry in Germany, where lignites are made into a highly desirable domestic fuel and where waste bituminous slack is utilized as a conservation measure. Foreign specifications for briquetted fuel are appended, as worked out for the Belgian, French and Prussian State Railways and for the Paris-Orleans Ry.

Locomotive service-run tests were made by seven railroads in various parts of the country in coopefration with the Geological survey and on one torpedo boat for practical comparisons of the same runs of coals, raw and briquetted. These tests are only very briefly spoken of in this bulletin.

From the data herein presented several things are to be inferred about the use of briquetted fuel for locomotive and similar service, where the combustion is rapid and the temperatures comparatively high: (1) The evaporation of water per pound of fuel is greater at all rates of evaporation than with raw coal and the boiler capacity is increased appreciably. (2) The quantities of cinders and sparks drawn from the firebox is not appreciably reduced by using briquets. (3) The smoke is less dense and the percentage of pitch binder seems to have very little effect on smoke or on evaporation. (4) With careful firing, briquets may be used to decrease locomotive smoke nuisance while running through city areas. (5) The briquetting of coal by the Geological Survey added about $1 per ton to the cost of fuel, and this is not compensated for by the increased efficiency of evaporation.

As briquetted coal had been tested, by the U. S. Geological Survey, under power boilers, with satisfactory results in economy and smokelessness, it was decided to find the value of similar coal for domestic heating boilers of the low-pressure, sectional type. At St. Louis, 58 tests were made—11 on raw coal and 47 with pitch-binder briquets. At Urbana 24 tests were made with the briquets.

A brief description is given in Bulletin 336 of house-heating boiler plants at the St. Louis structural-materials laboratory of the Geological Survey and at the University of Illinois engineering experiment station, Urbana, Ill.

Detailed results of the tests are shown in tabulated form. On comparing results of the tests there seems to be no advantage in briquets over lump coal of proper size for the grates. The pitch binders proved unsatisfactory at the low temperatures, and with the slow combustion of these small boilers. This caused undue smoking, gummed castings and decreased efficiency.

A phenomenon discovered by David T. Day forms the subject of the third bulletin. When crude petroleum was allowed to rise in a tube packed with fuller's earth there was a capillary fractionation of the oil into the different petroleum derivatives at different heights of the tube. A long line of experiments is disclosed and these seem of much interest to physical chemists and physicists and also to fuel engineers. The results deduced may be summarized as follows:

(1) The fraction at the top of the tube of fuller's earth is of lower specific gravity than at the bottom. (2) When water is added to the fuller's earth holding petroleum, the oil first displaced is of different specific gravity than that of the oil displaced by further addition of water. (3) When oil held by fuller's earth is later displaced by water, about a third of the oil remains in the earth. (4) When petroleum is allowed to rise in a tube of fuller's earth the paraffin hydrocarbons tend to collect in the lightest fraction at the top of the tube, and the unsaturated hydrocarbons at the foot.

CEMENT PIPE AND TILE.—Advantages of Cement for Pipe and Tile. Methods of Manufacture, Tests, Cost, etc. By E. S. Hanson, Editor "The Cement Era." Chicago, Ill.: The Cement Era Publishing Co. Cloth; 5 × 7¾ ins.; pp. 110; text illustrations. $1.

If due allowance is made for the altogether partisan treatment of the clay-concrete controversy, this is a useful book for the man who wishes to enter the concrete-tile manufacturing business. It details the probable and actual uses of concrete tile, shows beyond the possibility of a doubt (in the author's mind) the superiority of the concrete pipe over the clay tile, outlines the various methods of fabrication, gives considerable cost data and finally describes several existing plants, from a study of which the prospective maker can learn much.

Steam Power Plants.

Reviewed by LIONEL S. MARKS.*

THE ECONOMY FACTOR IN STEAM-POWER PLANTS.—By George W. Hawkins. New York: Hill Publishing Co. Cloth; 6 × 9¼ ins.; pp. 133; 49 illustrations, partly in the text, and numerous tables. $3, net.

HEAT ENERGY AND FUELS.—Pyrometry, Combustion, Analysis of Fuels and Manufacture of Charcoal, Coke and Fuel Gases. By Hans v. Jüptner, Professor, Imperial and Royal Technical Institute, Vienna. Translated by Oskar Nagel, Ph. D. New York: McGraw Publishing Co. Cloth; 6 × 9¼ ins.; pp. 306; 118 illustrations in the text and 136 tables. $3.

ANLEITUNG ZUR DURCHFUEHRUNG VON VERSUCHEN AN DAMPFMASCHINEN UND DAMPFKESSELN.—Zugleich Hilfsbuch für den Unterricht in Maschinenlaboratorien technischer Lehranstalten. By Franz Seufert, Principal of the Royal College of Mechanical Engineering at Stettin. Second edition, enlarged. Berlin, Germany: Julius Springer. Cloth; 5¼ × 8½ ins.; pp. 81; 40 illustrations in the text. 2 marks; American price, 80 cts.

The title of Mr. Hawkins' book is somewhat misleading, as the only problem dealt with is the determination of the fuel consumption of a steam plant per unit of power delivered. In his preface the author says "So far as is known there is not another single volume comprehensively treating this subject." If he will examine R. H. Smith's "Commercial Economy in Steam and Other Thermal Power-Plants," he will find a very much more comprehensive, but at the same time a very different, treatment of the subject.

Mr. Hawkins' book is written for oil-burning electric-power plants and the formulas deduced express the performance of the plant in KW.-hours per barrel of California crude oil; by the use of various conversion charts these results are readily changed into other fuel units. The author is obviously strongly influenced in his views and figures by the remarkable performance of the Redondo plant, which was communicated to the American Society of Mechanical Engineers in December, 1908.

The plan of the book is simple. First of all, the performance of the elements of a steam plant are considered; then a number of formulas are built up for the fuel consumption under full load test conditions for steam plants of various types; and finally, factors are determined for taking into account variable load and standing losses.

The accuracy of the results depends entirely upon the efficiencies assumed for the various elements of the plant. The values given can scarcely be accepted without question in all cases. The efficiency of a water-tube boiler using oil fuel is given as over 80% for a range of loads from 76% to 160% of the rated load; the efficiency being a maximum of 83% at 15% overload. In his paper on the firing of fuel oil (presented to the American Society of Mechanical Engineers in December last) Weymouth gave certain calculations of ideal efficiencies of boilers using California crude oil. With only 10% excess of air, with 3% assumed radiation loss, and with a chimney temperature of 400° F., the ideal efficiency is 84.2%. It is true that an efficiency of 83.3% has been recorded with California crude oil, but it does not seem probable that anything like that can be maintained in the normal operation of a plant. It should be noted that the steam used for atomizing the oil (usually from 2 to 3% of the steam formed) is not taken into account in these assumed efficiencies or in the test just referred to.

Steam engines are divided into four classes: automatic high-speed engines, four-valve engines, gridiron-valve engines and turbines. The steam consumption to be expected from the best examples of these types, condensing and non-condensing, simple and compound, at various loads, and with units of various sizes, is given by a number of economy curves. The author certainly does full justice to the extraordinarily good results obtained from the large McIntosh & Seymour engines; he assumes 10.5 lbs. of steam per I. HP. per hour from 48 to 100% of the rated load, and a mechanical efficiency at full load of 96%, for the 5,000-KW. units. To the steam turbine, however, he does not do justice; for 5,000-KW. units he shows a steam consumption increasing from 16.7 lbs. per KW.-hour at full load to 19.6 lbs. at half load., and that with the same superheat as in the McIntosh & Seymour engines. A considerable decrease in efficiency with decrease of load is not a necessary characteristic of the steam turbine. An 8,000-KW. turbine of a well-known type with superheat and vacuum slightly better than the conditions assumed for the 5,000-KW. unit, gives a KW.-hour on 14 lbs. of steam at full load, and on 14.4 lbs. of steam at 60% of full load.

The amount of work done, and the probable steam consumption per I. HP. per hour, in the various auxiliaries, air pumps, circulating pumps, feed pumps and oil pumps are treated of briefly. There is not much use in calculating the power of the feed pump as exactly as is done, when it is not known whether the steam consumption of the pump is to be 80 or 240 lbs. per I. HP. per hour. It would have simplified calculations and would probably have been just as accurate if the steam consumption of the feed pump had been assumed to be a definite fraction of the total feed water.

The information given as to boilers, engines and auxiliaries is made use of in the construction of various formulas for finding the fuel consumption of projected plants at full load. The plants are divided into (1) non-condensing, (2) surface-condensing, and (3) jet-condensing plants. Formulas are worked out for a non-condensing plant, a surface-condensing plant with steam driven auxiliaries, a surface-condensing plant with power-driven auxiliaries, a jet-condensing plant and for three types of pumping plant. The equations deduced are simple equations involving the steam consumptions and efficiencies of the various parts of the plant, the factor of evaporation and the calorific value of the fuel. The engineer is saved the solution of these simple equations by numerous full-page and double-page graphs and by numerous tables. Examples of the use of the formulas are given. Finally, the method of modifying the formulas for variable load and for stand-by losses is given briefly and is illustrated by an elaborate example.

The book represents a great deal of labor in compilation and in the drawing of sets of curves. But it is doubtful if it has accomplished anything of value to the engineer. When the anticipated performance of each member of a plant is known it is a simple matter to find the fuel consumption of the whole plant, and it is surely more satisfactory to an engineer to work it out for himself than to take a formula containing certain constants which naturally he cannot accept without examination. The formulas have only an academic interest, and the tables and curves, since they save only a few multiplications, divisions and additions, have as their practical value only the light which they throw on the influence of various factors on the fuel consumption.

The author himself is not always correct as to the influence of the various factors. He states that the fuel consumption of a plant varies inversely as the factor of evaporation, and this opinion is based on the observation that the factor of evaporation occurs in the denominator of each of his formulas for fuel consumption. But he is obviously incorrect. The same factor of evaporation may occur in a plant with (1) cold feed water and no superheat, or with (2) hot feed water and a high superheat. The greater efficiency of the engine in this latter case will decrease the total fuel consumption. Among other errors it may be noted that the efficiency of a perfect engine using superheated steam is given as $\frac{t_1 - t_2}{t_1}$ t_1 and t_2 being the absolute temperatures of the steam at admission and exhaust respectively.

It is to be regretted that the author did not make his work more comprehensive by giving the data for determining the commercial efficiency of steam plants. There is a distinct need for more information on the subjects of the first cost, depreciation, cost of repairs, supplies, the attendance and the numerous other factors that go to determine the total cost of the unit of power. Something of this kind was done about 16 years ago by Dr. Emery, who worked out the actual cost of power under a large variety of assumed conditions; his figures were very useful at the time, but now they are naturally of historic interest only.

Professor v. Jüptner has written a compendious four-volume work on chemical engineering. He divides the subject into two parts; in one the object of the process is to transform chemical energy into other forms of energy; in the other, to transform raw materials by chemical processes into substances of a different chemical composition. The first volume deals with energy transformations, and is itself divided into three parts; Part I. takes up the subject of heat measurement, combustion and fuels; Part II. contains the science of firing, with a discussion of the different methods of industrial firing; Part III. treats of the chemical methods of refrigeration. The work which is before us is a translation of Part I. of Volume I.

Many of the comprehensive and exhaustive treatises covering a whole field of technology which have appeared from German pens are monuments rather to the patience and industry of the author than to any more inspired quality. In the present case, however, we have a work by a man whose name is associated with much important research in his field, and who is in other ways eminently well qualified to undertake the work.

After a chapter of general remarks introductory to the whole subject of chemical engineering, and another chapter dealing with the forms of energy and the laws of energy transformation, the author takes up the subject of heat measurement. Three chapters are devoted to the measurement of high temperatures, with descriptions of the instruments, their theory, errors, methods of use, reliability, and so forth. Mercury thermometers, graphite and metal pyrometers, Wedgewood's clay pyrometers, gas thermometers, thalpotasimeters, Princep's alloys, Seger cones, calorimetric pyrometers, optical pyrometers, electric resistance and thermo-electric pyrometers and the thermophone are all considered in much detail. The principal results of investigations of these instruments are stated and some thirty tables of physical constants relating to them are given.

The experimental determination of the heat of combustion of fuels is taken up rather less comprehensively, the Fischer constant pressure calorimeter, the Mahler constant volume calorimeter and the Parr calorimeter alone being de-

*Assistant Professor of Mechanical Engineering, Harvard University, Cambridge, Mass.

scribed. The method given for finding the lower heat value of coal from a Mahler bomb determination (by absorbing the moisture of the products of combustion in a calcium chloride apparatus and correcting for its latent heat) has been shown by Hempel to be incorrect on account of the presence of the sulphuric acid which results from combustion of the sulphur in coal and which retains some of the moisture. A clear discussion is given of the relation between combustion heats at constant volume and at constant pressure, and also of the relation between combustion heat and combustion temperature. This latter is commonly neglected by engineers, but is of importance in gas engine practice; for example, the heat of combustion of Carbon monoxide at 1,000° C. is about 2% lower than its heat of combustion at 15° C.

The chapter on the indirect methods of determining the heat of combustion of fuels has an account of the attempts (of which several are very recent) to establish some relation between various characteristics of the fuel and its heat of combustion. The calculation from the elementary analysis is well known (Dulong's formula), as is also the method based on the determination of the oxygen required for combustion (Berthier's method). Gmelin's method is based on the ability of the coal to retain hygroscopic water, and with the constants which he gives, yields better results than Berthier's process. The author's method is much more rational and accurate; it depends on the proximate analysis and on the oxygen required for combustion of the volatile matter. The formulas of Arth, Goutal, Mendeléeff and de Paepe are also given.

Many recent investigations have thrown considerable light on the subject of chemical equilibrium and on the influence of pressure, temperature and concentration on the dissociation accompanying chemical reactions. The effect of these factors in determining the completeness of combustion and the temperatures resulting from the combustion of gaseous and solid fuels is gone into very completely and clearly.

The remainder of the book takes up the study of fuels, classifies them in many ways, gives numerous tables of their chemical composition, heat values and physical characteristics, works out the chemical relationship between the various natural fuels and describes the apparatus and methods of making the principal artificial fuels. Separate chapters are devoted to wood, peat, lignite, bituminous and anthracite coal, charcoal, coke and coking apparatus. Liquid fuels are disposed of summarily. Producer gas, water gas, Dawson gas and producer gas plants have each a separate chapter. The theoretical composition of producer gas and water gas are worked out under various assumed conditions of pressure and temperature with the aid of the valuable investigations of Boudouard, and important deductions are made as to the desirable working conditions in a producer.

The most valuable part of this book to the practicing engineer is 137 tables of physical constants and chemical composition which are incorporated in the text, and which give a large mass of information in a well arranged and well digested form. For the student the theoretical parts, the application of the new methods of physical chemistry to the technical problems of combustion should prove of great interest.

The work of the translator and of the proof-reader have been done so poorly as to render certain parts of the book almost unintelligible. For example, we find the following "reason" for the use of excess air in combustions: "The reason for this is the difficult and incomplete mixture of the gases to be burned with the combustion air and the occurrence of incomplete reactions." Another example: "Pyrometric thermal efficiency is called the temperature that can theoretically be reached by combustion of the fuel." The chemical equations are full of errors.

Prof. Seufert's small book is a concise, clearly written laboratory manual, of an elementary character, for steam-engine and boiler testing. The instruments, arrangement of apparatus, methods of procedure and of calculation for making commercial tests of steam machinery are explained very simply, with illustrative examples taken from practice. If someone would take this book as a basis and would write an engineering laboratory manual covering a much wider range, but following the same general method, it might fill a much-felt lack in engineering text-books in the English language.

MECHANICS OF ENGINEERING.—Comprising Statics and Kinetics of Solids, the Mechanics of the Materials of Construction, or Strength and Elasticity of Beams, Columns, Shafts, Arches, etc., and the Principles of Hydraulics and Pneumatics, with Applications. For Use in Technical Schools. By Irving P. Church, Professor of Applied Mechanics and Hydraulics, College of Civil Engineering, Cornell University. Revised Edition, partly rewritten. New York: John Wiley & Sons. London, England: Chapman & Hall, Ltd. Cloth; 5¾ × 9¼ ins.; pp. 854 + xxvi.; 657 illustrations, mostly in the text. $6; English price, 25c. 6d., net.

Since its first publication in the late eighties, Prof. Church's exhaustive treatise has been the backbone of the study of engineering for a generation of students in various colleges of the country, more especially at the university where Mr. Church himself has supervised with marked ability the instruction in this most important of the theoretical portion of an engineer's training. No additional praise that can be given here will add to the already assured reputation of the book. The treatment is so thorough that at first it seems unnecessarily long and complicated, but once the general scheme is mastered, a fair knowledge of the calculus, being assumed, the uniformity of method and the continuity of the development convey a certain simplicity which is a surprise to the student, who, at first, is bewildered by the apparently indigestible mass of the book. It is primarily a text-book for students, with the rare characteristic, an adaptability to the practicing engineer. Those engineers who used the book in their college days generally keep it as a rather ponderous vade mecum to which the more abstract problems of their professional work may be referred.

This last edition is to a large extent rewritten and rearranged. Practical problems have been added at the end of each section, matter of occasional interest relegated to an appendix and the older formulas, references and designs brought up to date. Additional matter has been added in the shape of a chapter on reinforced-concrete beam design and in the theory of circular ribs and hoops and thick hollow cylinders and spheres.

A German Manual of Material-Testing.

HANDBUCH DES MATERIALPRUEFUNGSWESENS FUER MASCHINEN- UND BAUINGENIEURE.—By Otto Wawrziniok, Adjunct at the Royal Technical College, Dresden. Berlin, Germany: Julius Springer. Cloth; 6 × 9¼ ins.; pp. 573; 501 illustrations, mostly in the text. 20 marks; American price, $8.

This is essentially a condensed treatise on German testing methods. The author takes the scientific viewpoint. That is to say, he deals with laboratory testing rather than shop or field testing. This is no defect, of course, since it tends toward thoroughness and precision, but it leads him to omit mention of the numerous rough-and-ready or less precise methods that characterize shop testing.

Besides describing methods, the book gives a long chapter to testing-machines, in which some twenty-five machines are described and illustrated by drawing and photograph. These are all German machines, however; not a single British or American machine is mentioned, not even the unique Emery machine at Watertown.

In fact, the entire book is confined to German practice, and while this may be approved as far as the general plan of the book is concerned, it tends to produce frequent misconceptions, especially in the chapters on methods of testing. Thus, under the head of form of tension test-piece (of round steel or iron), the reader is told only of the turned test-piece with enlarged heads for the grips and taper portions adjoining the straight middle portion; but he ought also have been informed that straight round rods held in wedge grips give excellent results in America, the fracture rarely occurring in the grips. Again, under the head of cement briquets, he should be told that American cement testing does not approve of tamping the mortar in the mold, and that most results reported from America refer to untamped briquets.

Besides methods and machines, two or three other subjects are included in the book. There is a chapter on measuring instruments—excluding load-weighing appliances and gages, which are included with testing-machines, Vernier and micrometer scales, extensometers, balances, instruments for specific gravity determinations, thermometers and pyrometers and the like are described in this chapter, much of which seems to belong more properly in a physics laboratory manual. Another chapter is taken up with tests of completed articles and structures—as load tests of sewer pipe, floor slabs, stairs, etc., and fire tests. This may be considered quite foreign to the general plan of the book, inasmuch as these tests are exclusively "practical" and, with rare exceptions, are special to the individual case. On the other hand, it is gratifying to find a chapter on Elements of Metallography and a short appended section on the non-microscopic structure of wrought-iron and steel; both these sections may prove serviceable to the practical tester no less than to the student.

The two main parts of the work deal respectively with tests of metals (160 pp.) and tests of materials other than metals (150 pp.). These chapters present an excellent, well-arranged account of the various processes of mechanical testing, and the attendant phenomena. The treatment, besides being not as exhaustive as that of a treatise, is conservative, in that such matters as notched-bar tests and tests under reversed stress receive but scant notice. The restriction to German practice must also be remembered. There are some minor weaknesses, moreover; for instance, a statement that there are three "elastic limits," namely, the yield-point, the limit of proportionality and the limit of elasticity, is expressed in confusing manner, while at another point is found a statement that in an electric resistance heater "it is clear that a different temperature must prevail at the beginning of the helix than at its end." But these defects are relatively imperceptible, and on the whole the two chapters in question give a valuable presentation of the subject. The value of the book depends mainly on these chapters. For the American reader, therefore, the work affords a good survey of the methods employed in scientific material-testing in Germany.

ARTIFICIAL WATERWAYS AND COMMERCIAL DEVELOPMENT.—(With a History of the Erie Canal). By A. Barton Hepburn, LL.D., D.C.L., Author of "The Contest for Sound Money," etc. New York: The MacMillan Co. Cloth; 5 × 7¾ ins.; pp. 115. $1, net.

The reader who expects to find in this book a broad, general review of the whole subject of waterways, with apreciation of their economic relations to modern transportation systems will certainly be disappointed. The author of the book, a New York banker, has apparently obtained his knowledge regarding waterways from the campaign literature widely circulated in connection with the movement to secure state appropriations for the building of the $101,000,000 barge canal across New York nine years ago. Of the 92 pages which the book contains, 62 are devoted to one chapter on the Canal system of New York, and the remainder is taken up with 8 pages on the Panama Canal and 15 pages in which the Canals of the world are summarized. An appendix of a dozen pages contains statistical tables of some value, relating chiefly to the operation of the New York canals.

The author lays great stress upon the idea that the artificial waterways of the country have been abandoned because they were under public ownership and were not maintained and operated as they would have been by a private enterprise, in the same manner as the railways. He makes no mention of the fact that a considerable part of the canals which have been abandoned were actually owned and operated by private companies. There is need of a really first rate book in the field which this one pretends to cover, but it should be written by someone with a broader viewpoint and greater technical knowledge than the author of this work.

How to Solve Some of the Problems of Municipal Government.

PROBLEMS OF CITY GOVERNMENT.—By L. S. Rowe, Ph.D., LL.D., Professor of Political Science, University of Pennsylvania. New York: D. Appleton & Co. Cloth, 5 × 8 ins.; pp. 358. $1.50, net.

The theme of a large part of Prof. Rowe's book is that the form or mechanism of city government is not to be adapted to the function of the city as an organization. This makes the volume timely in these days of charter making and mending.

After dealing with the history of cities from ancient to modern times, Prof. Rowe considers "The Nature of the Municipal Problem." The briefest expression of this problem that we find in the chapter devoted specifically to it is a sentence setting forth present shortcomings, as follows:

> The lack of definite civic standards and ideals, the absence of an intense city life, the failure to develop a distinctive form of municipal government and to establish definite relations between the municipality and the state constitute the main counts in the indictment against our existing system.

We need "new civic standards, based upon distinctly city ideals." We need, also, to get away from the idea that city government should be modeled after state and national governments, with their checks and balances; and we should recognize that "city problems are primarily of an administrative rather than a political character, and that "neither the mayor nor councils can encroach upon the civil and political rights of the citizen." The city problem being so largely administrative in character, a large measure of reliance must be placed on department heads, and these should be chosen for ability and retained in office as long as they perform efficient service.

The social and also the political consequences of city growth are next elaborated upon, after which the author states his conception of "The Position of the City in the American Political System." The central idea of this chapter is that the city should be given what it now so generally lacks, a well-defined place of its own, free from state interference except as regards essentially state as distinct from local policies. In other words, an adequate measure of "home rule" is demanded. This, in turn, requires effective central administrative control. Such control substitutes the expert supervision possible under a board selected for the purpose for the necessarily know-nothing control or interference of a heterogeneous assemblage of state assemblymen and senators. In the course of this chapter the Western practice of allowing cities to frame their own charters is reviewed.

Chapters on the legal powers and on the organization of cities follow. The first of these needs no comment save general approval. In the second the author ably sets forth the American "faith in mechanism," as exemplified by its many and continuous changes in the form of city government. In contrast:

> It is a remarkable fact that while the form of municipal government in continental Europe has remained almost unchanged during the last century, the cities of the United States have been passing through at least three distinct stages, in each of which an essentially different form of municipal organization has prevailed. Europe has been endeavoring to perfect the operation of a given system, while in the United States we have been searching for a form of government so perfect in its adjustment as to assure efficiency without the necessity of the constant vigilance and active cooperation of the population.

The author divides municipal development in the United States into three periods: (1) Council supreme, in some cases even electing the mayor, as is still the case in Great Britain; (2) distribution of powers between council and mayor; (3) "the mayor acquires a dominant position, while the elective council is gradually stripped of its more important functions." In so far as the latter stage has not yet been reached we are rapidly marching towards it to-day. The departure from the last-named movement, and a most notable one, is the "commission plan," in which a council of only five members, including the mayor, is at once a legislature, appropriating and executive board, with each of the five members or else all but the mayor, a department head. Here the old system of "checks and balances" disappears completely, and also all separation of legislative and executive functions. With the commission system, responsibility is concentrated in the highest degree short of one-man authority, and public opinion can make itself felt as under no other plan. But public opinion, to be effective, must be intelligently guided (the Bureau of Municipal Research, New York City, is an example of a possible guiding method). Public opinion must be exercised with restraint. It must be brought to bear upon State legislatures as well as on municipal officials, especially as our author does not believe it wise, in the movement for home rule, for the legislature to strip itself quite so fully of the power of municipal control as some reformers urge. In leaving this chapter we quote its final sentence, which bears upon the last points made:

> The standards of public opinion must be so well defined and the standard of capacity of the legislatures so high as to assure the continuous recognition of those principles of government upon which the successful working of democratic institutions rests, namely, confidence of the people in their representatives, combined with a degree of self-control in the state legislatures, which will enable the municipalities to determine their local policy without fear of interference from without.

In the course of his valuable chapter on "City Government and American Democratic Ideas," the author again points out the necessity of getting away from the notion that municipal government should be framed with the protection of individual rights as its chief concern. Instead, it should be directed to meet the wants of modern city life through organized collective action. To get things done and done well cities will have to pattern more and more after the executive management of commercial and industrial corporations. The author says:

> The desire for greater administrative efficiency may lead us to a type of government in which the determination of executive policy will be left exclusively to the mayor and his heads of departments. * * * The accumulated experience of American cities has shown that unless the council is reduced to a single chamber, with a small membership, responsibility cannot be enforced.

If the council be retained it must not only be small (11 or 9 members), but, to prevent continual interference with the mayor and other executive heads, its activities must be rigidly restricted to legislative functions. Councilmanic control of appointments to executive offices destroys responsibility and impairs the efficiency of the whole executive (or doing-things) department of the city—and the city of to-day, if it fulfils its functions, exists primarily to do things. This chapter concludes as follows:

> It is important for those who are interested in the betterment of city government to realize that while in the organization of government compromises may be attempted, the actual operation of any system is determined by deep underlying forces over which the individual has little control. The compromises that have been dictated by our unwillingness to accept the consequences of certain fundamental canons of political organization have placed our city governments at the mercy of a small group of men who understand these principles more clearly than we, and who are able to manipulate this organization for their own ends.
>
> The traditional fear of absolutism need not deter us from making the mayor the real executive head of the city government. Correctly interpreted, this plan offers possibilities of popular control which our present system lacks. At all events, it is well for us to understand that the demand for efficiency, which the American people place above their desire for democratic rule, will inevitably lead to this concentration of executive power. The real alternative is, therefore, whether this concentration of power will be accompanied by the destruction of the city council, or whether the city council will survive as an organ of government restricted to purely legislative functions.

The remaining third or more of the book must be dealt with more briefly. It has to do wholly with the control of public-service corporations and with municipal ownership. Besides discussing fundamental principles, the author uses as concrete illustrations Philadelphia's experience with municipal and private ownership of gas-works and German experience with city ownership of street railways. Both these chapters abound with instructive and interesting facts and figures and equally commanding deductions therefrom. The final chapter of the book is on "Municipal Ownership and Operation: The Value of Foreign Experience.

Many weak and sore spots in municipal government are exposed to view in these chapters, and likewise many faults of private ownership of public utilities. Foreign experience, the author urges, should be considered judicially, with both the pros and cons before one. After which deductions should be applied with a full understanding of differences in foreign and American conditions.

The author appears to incline strongly towards municipal ownership, with limitations set in each case by local conditions. He believes that only by extending municipal activities can the needs of the city dweller be met, and that in meeting these needs a civic spirit and ideal will be created that will react favorably upon both the citizens and their public servants. This will lead to a wider, deeper and more intelligent popular interest in municipal affairs and greater efficiency on the part of municipal officials.

EX-MERIDIAN ALTITUDE, AZIMUTH AND STAR-FINDING TABLES.—With Diagrams for Finding the Latitude and Facilitating Plotting Lines of Position and Giving New and Practical Methods for Identifying Stars in Cloudy Weather. Latitudes 0°-65°; Declinations 0°-71° North and South. By Lieutenant-Commander Armistead Rust, U. S. Navy. New York: John Wiley & Sons. London, England: Chapman & Hall, Ltd. Cloth; 6 × 9½ ins.; pp. ii. + 393; six folding plates. $5.

These navigation tables and diagrams center about a table of first approximation for reducing the star altitudes to meridian altitude. In this, each integral degree of latitude has six pages, in which the values of the reduction are given for declinations in whole degrees, north and south, and for hour-angles varying by 4 mins. up to 60 mins. The tabular value is the "first reduction." For each declination there is also given the value of change of altitude per minute of hour-angle, and its logarithm, which serve variously in checking hour-angles, etc. This main table occupies 393 pp. The auxiliary tables are: (1) a two-page table of 5-place logarithms; (2) corrections to altitude observations (horizon, refraction, semi-diameter, etc.); (3) corrections for height of eye (less or more than 20 ft.); (4) altitude corrections per minute of time; (5) errors due to errors in latitude; (6) arc and time equivalents; and (7) hour-angles and altitudes at prime vertical transits, for latitudes and declinations varying by whole degrees. There are six plates, containing the "second reduction," etc. The introductory text is very brief, too brief, perhaps, for the desired degree of clearness.

NAUTICAL CHARTS.—By G. R. Putnam, M. Am. Soc. C. E., Director of Coast Surveys, Philippine Islands, 1900 to 1906. New York: John Wiley & Sons. London, England: Chapman & Hall, Ltd. Cloth; 5¾ × 9¼ ins.; pp. 162; folding and other plates. $3.

The intricacies of mapping the high seas and coastal waters are described simply but instructively in Mr. G. R. Putnam's "Nautical Charts." The age of the subject, and its slow development to the high level attained to-day, are sketched in an opening chapter on the history of sailing directions and charts of the sea. The author then describes the survey methods, the processes involved in making the drawings and plates from which the printed charts are produced, the governmental conduct of the work, etc., etc. The book was prepared in connection with a lecture on charts delivered at Columbia University, and therefore bears the characteristics of a semi-popular work. But it is clear and instructive as far as it goes, and the fact that it leaves the wish that the author had taken time to go more into detail may be due to his success in engaging the reader's interest.

That the book deserved to be written is further grounded in the fact that there exists no general writing on nautical charts, although the subject of maps and mapping of land areas is treated in numerous books and is generally understood. Yet charts are perhaps more numerous than land maps, for the various governmental and private chart publishers issue over a million copies of charts per year (according to the author), comprising about 10,000 different sheets.

COMMISSIONER OF HIGHWAYS (Maine).—Annual Report for the Year 1908. (Paul D. Sargent, Commissioner.) Augusta, Me.: Pub. Doc. Cloth; 5½ × 9¼ ins.; pp. 212; plates and tables.

Besides reviewing the work of the year, some cost data are given. The proceedings of the First New England Road Conference, held in Boston Nov. 23-24, 1908, are given 26 pages.

A New Book on Steam Turbines.

Reviewed by A. G. CHRISTIE.*

THE STEAM TURBINE.—A Practical and Theoretical Treatise for Engineers and Designers, Including a Discussion of the Gas Turbine. By James Ambrose Moyer, M. Am. Soc. M. E., M. Am. Inst. E. E., Engineer, Westinghouse, Church, Kerr & Co., Author of "Descriptive Geometry for Students of Engineering," etc. New York: John Wiley & Sons. London, England: Chapman & Hall, Ltd. Cloth; 5¾ × 9¼ ins.; pp. 370; 225 illustrations in the text and 1 folding diagram in pocket. $4.

The art of steam-turbine construction has advanced so rapidly during the last few years that the majority of engineers have been unable to keep fully in touch with the theoretical and commercial questions involved. Much of the earlier literature on the subject dealt largely with the theoretical questions and made little attempt to modify the theoretical results to fit practice. The attempt to do this in the above book is a step in the right direction.

It is rather hard to place this book of Mr. Moyer's. While excellent in many ways, it would scarcely do for use by students in engineering nor yet is it a handbook for the average operating engineer. It includes in general the class of information regarding steam turbines which is in circulation, especially among commercial engineers, modified to some extent by methods and formulas introduced by the author.

Its unfitness as a book for students' use is mainly because of the substitution of empirical formulas in many cases where it is important that the students should study the theoretical equations representing fundamental principles and to understand how these are modified to suit conditions found in practice.

There is no doubt that a careful study of steam-turbine data would show that many relations could be expressed adequately for engineering purposes by empirical formulas, and the author has endeavored to do this in the present book. However, in most cases, he does not lay before the reader the experimental data on which he bases his results. Were these presented it would materially increase the value of the book.

Another very noticeable feature of the book is the great number of foot-notes which, in many cases, could have been included in the text without over-burdening it.

In the first chapter, the author gives a brief historical review of the earlier steam turbines. The second chapter treats the elementary theory of heat as applied to steam turbines in a very simple and comprehensive manner. Entropy-temperature diagrams are employed to advantage to illustrate the action of the steam. The application of these diagrams to superheated steam might well have been placed in this chapter instead of in the following one.

In Chapter 3, nozzle design is discussed, and a number of empirical formulas introduced which greatly simplify the solution of problems. On page 45 the author should make it more clear that the formula given for length of nozzles applies only to types where the pressure difference on the two sides of the nozzle is relatively small. The treatment of the subject in general is clear.

Chapter 4 is devoted to the discussion of steam-turbine types and blade design. In discussing the impulse turbines, the author's references to "velocity stages" and "pressure stages" are apt to be confusing to a reader not thoroughly acquainted with the various types of turbines. The diagram on page 79 is misleading, as impulse blades are shown to illustrate velocities in reaction blading. The author's design of a Parsons turbine follows the old method which he, himself, styles "rule of thumb." Much better results have been obtained in practice by designing with the use of the heat diagram, assuming non-adiabatic expansion. A thorough investigation of the nature and location of the losses in a Parsons turbine will probably lead to greater improvements in general results than those the author suggests, which have mainly to do with the mechanical construction and do not throw light on the conditions affecting economy.

In Chapter 5, dealing with the mechanical losses in steam turbines, the formulas on friction losses would be improved by the inclusion of the experimental test data from which they are derived.

Chapter 6 shows the methods for correcting steam-turbine results to reduce them to standard conditions. Chapter 7 takes up commercial types; Chapter 8 with the methods of governing steam turbines; Chapter 9 with low-pressure steam turbines, and Chapter 10 with marine turbines. One cannot help noticing, in reading these chapters, that while Curtis and Westinghouse-Parsons turbines are described very fully, the author seems to have had no experience with other types and has described them after the fashion of trade catalogs and magazine articles.

Chapter 11 briefly describes test methods. Steam-turbine economics are dealt with in Chapter 12. In this chapter the author's statements regarding the relation of altitude and vacuum are misleading. Between the same limits of absolute pressure, the economy of the steam turbine is independent of the altitude, and hence relatively high vacuum is as desirable at high altitudes as at sea level. The work required of the condenser auxiliaries, however, become less as the altitude is increased. The author has evidently got his types of turbines interchanged on page 282 in discussing the best economic results with superheat. It is generally understood that Curtis turbines give higher superheats than do the Parsons.

In Chapter 13, discussing the stresses in rings, drums and disks, the author does not make himself clear, on page 319, where "N" may mean the increase in thickness of the shaft due to the weight of the blades, or the thickness of shaft itself, inwhich case it is far too small to be of any practical value.

The gas turbine and its possibilities are discussed in Chapter 14, and electric generators for steam turbines are briefly dealt with in Chapter 15.

*Research Assistant in Engineering, University of Wisconsin, Madison, Wis.

A Dictionary of Railway Signalling.

RAILROAD SIGNAL DICTIONARY.—An Illustrated Vocabulary of Terms which Designate American Railroad Signals. Their Parts, Attachments and Details of Construction, with Descriptions of Operations and Some Illustrations of British Signals and Practice. Compiled for The Railway Signal Association by Braman B. Adams and Rodney Hitt, Associate Editors of the "Railroad Gazette." New York: "Railroad Age Gazette." London, England: "The Railway Gazette." Leather; 8½ × 12 ins.; pp. of text, 32; 3,120 illustrations. $6.00.

In 32 pages of dictionary text and 472 pages of illustrations, interspersed with a small amount of text matter, Messrs. Adams and Hitt have embodied a very ambitious attempt to set forth the arrangements and mechanisms of American railway signaling and interlocking in full detail. How their attempt has succeeded is to be judged by the completeness and correctness of the information they present, and by its acessibility, that is to say the ease of finding a desired piece of information.

As to completeness, the authors have not only attained their mark, but overshot it considerably. Much space is wasted in what is really duplication. To cite a single instance: page 192 is occupied by drawings of no less than 14 "box wheels" (chain guide-wheel sets for mechanical signal connections) which are all exactly alike except for the number of wheels in the set, the smallest having 4 wheels, the largest 20 wheels. This page, with three other pages of illustrations of chain and wire guide wheels, could have been adequately covered in one-eighth as much space, half a page. There is a large amount of similar waste throughout the book. Partly on this account the illustration part of the book virtually forms a consolidated catalog of signal manufacturing companies, rather than an illustrated cyclopedia or album of the art.

As to accessibility, the authors have probably done the best that was possible with the unwieldy mass of material. The dictionary text, of course, was easily handled; it is alphabetically arranged, and wherever possible the definition is helped out by a reference to the appropriate illustrations in the album section. The album, however, is a different problem. The authors group the illustrations in five parts: Signal Indications, Block Signals, Highway Crossing Signals, Interlocking, Block and Interlocking Accessories; groups overlap to some extent, yet a reasonable separation of matter. group, however, the arrangement is trary. As the largest group (Inter ers 187 pages, with 1,407 illustrati be very difficult to find a particular arrangement if some further aid were This is found in a classified index a betical index, given at the begin album. By their means the compl of 2,850 illustrations becomes reason ible.

The work is more effective in its of details than in its statements of principles. The details of interlock and accessories, for instance, are ve forth, but the explanation of the act of interlocking in the machines can called successful. The Dictionary is to the learner in signaling, therefore tion is to serve as a reference manual tifarious commercial mechanisms that make up the present-day art.

In contemplating the great labor and represented by this book, one regrets that practice in railway signaling is omitt especially as it could well have been put out increasing the bulk, by saving the wasted in purposeless repetitions, as referred to. There is regret, also, that the were so conservative that they devoted page to the subject of automatic stop only one device), while such devices as signals are not shown at all.

Altogether the authors have accomplished a very difficult and ungrateful task in highly commendable manner. The real value and effectiveness of their work, we may presume, must be judged by the market which the book will find. If it should reach a second edition, as is to be hoped, there will be opportunity for simplification and shortening, and for covering also European practice.

MODERN METHODS OF SEWAGE DISPOSAL.—A Practical Handbook for the Use of Members of Local Authorities and Their Officials. By W. H. Trentham, M. Inst. M. E., M. Inst. E. E., and James Saunders, Assoc. M. Inst. C. E. London, England: The Sanitary Publishing Co., Ltd. Cloth; 4¾ × 7½ ins.; pp. 60; 14 plates. 2s. 6d. net. American price, $1.

Although this little book is designed primarily for laymen, it will well repay many engineers not conversant with the larger books on sewage treatment to spend the half-hour or so necessary to run through its pages. The principles of sewage treatment are briefly and plainly set forth, as also the leading facts regarding modern systems of treatment. A section of value and interest to the American reader would be the eight pages devoted to the "Powers and Duties Imposed on Local Authorities by the Legislature." The authors appear to be particularly impressed by the Dibdin slate bed as a means for the preliminary treatment of sewage. They go so far as to say that for this purpose nothing "can compare" with the slate bed, and that "the total elimination of the sludge difficulty" is thus effected. Illustrations of actual sewage works, drawn from the practice of the authors, are presented.

GUIDE TO SANITARY INSPECTIONS.—By William Paul Gerhard, M. Am. Soc. M. E. Fourth edition, entirely revised and enlarged. New York: John Wiley & Sons. London, England: Chapman & Hall, Ltd. Cloth; 4¾ × 7½ ins.; pp. 229. $1.50. English price, 6s. 6d., net.

Included with the new matter given in this edition is a chapter on the sanitary inspection of public buildings, and another on sanitary surveys of cities and towns. Many question schedules or blank forms for use in recording the results of inspections are presented. Since the book is now in its fourth edition, nothing further need be said regarding it, except that a great deal of time and space might have been saved by laying down first of all the features of sanitary inspection common to all buildings, and then citing variations for city and country houses, schools, hospitals, etc. There is, of course, some advantage in having each section complete, but we do not think that it begins to compensate for the disadvantages and for the necessary additional cost of the book.

Applied Mechanics.

Reviewed by ALFRED H. KNIGHT.*

APPLIED MECHANICS FOR ENGINEERS.—A Text Book for Engineering Students. By E. L. Hancock, Assoc. M. Inst. C. E., Professor of Applied Mechanics, Purdue University. New York: The Macmillan Co. Cloth; 4¾ × 7½ ins.; pp. 385; 205 illustrations in the text. $2.

In the engineering schools in this country the need has been felt for a wider application of the principles developed in the mathematics courses, so that the student might be better able to make use of them in a practical way. Practicing engineers as well as students have gone so far as to say that much of the time spent upon pure mathematics was wasted, except for the mental discipline obtained. Necessarily the mathematician and the engineer regard the subject from different points of view. To the engineer the application is the all important part; to the mathematician it is merely an incident.

Evidently, with a realization of this condition, Prof. Hancock has endeavored to prepare a text which would give abundant application to every principle developed, and in this application to use problems such as an engineer would be likely to encounter. In this endeavor he has been reasonably successful, though, unfortunately, the general treatment of the subject and the methods of attacking problems do not seem to be quite in accordance with the methods of the engineer. It is hardly fair, however, to condemn the book upon this ground, since the same criticism applies with equal force to the older works upon this subject.

Presupposing a knowledge of algebra, trigonometry and calculus, the solution and composition of forces is first taken up, following which is a chapter on centers of gravity, treating the subject at somewhat greater length than is usual in texts of this character. Methods for finding the centers of gravity of plane areas and solids are fully discussed. In addition to the use of calculus, Simpson's rule, which should be better known to engineers, is explained and its use illustrated.

Couples and non-current forces are discussed in the two following chapters. The vector method of representing couples is used, and the general problem of non-concurrent forces in space is treated at some length.

A long chapter is devoted to moments of inertia. Methods for finding moments of inertia of areas and solids for both parallel and inclined axes are explained. In this chapter the author makes an exception to his usual rule and introduces a graphical method. It is to be regretted, however, that the most important feature of this construction has been omitted.

In the chapter on flexible cords a very good treatment of the catenary is given and a number of other common problems are discussed briefly.

Rectilinear, curvilinear and rotary motions are given an extensive and very satisfactory treatment. The chapter on dynamics of machinery, among other things, discusses the important subject of gyroscopic action which is lacking in many of the older books. Balancing of revolving masses is also considered, though the treatment is not entirely satisfactory.

The difficult subject of friction is discussed at considerable length and formulas for various types of bearings are developed upon the tacit assumption of a uniform distribution of pressure. Belt friction, band brakes and several types of dynamometers are explained and the usual formulas derived.

The book concludes with a chapter on impact, which treats the subject very completely.

In general, the subjects discussed are presented in a clear manner and there is an abundance of figures illustrating the text. Some few misleading statements are noticeable, as when the author states in deriving an expression for the tractive effort of a locomotive:

> We may disregard the work of friction of the cylinder and cross-head since the sum is zero. That is, the work done by the piston on the cylinder, due to friction, equals the work done by the cylinder on the piston due to friction.

There are also a number of minor errors both in the text and in the figures, but perhaps not more than might be expected in a first edition.

The book abounds in problems designed to furnish application for every principle developed. Many of these show originality and they are in general of a practical nature.

No pretence is made of treating of the strength and resistance of materials and no mention is made of stress except in the discussion of impact, where the author gives a brief explanation of the modulus of elasticity. Bending moments are carefully avoided and graphical methods are noticeably absent.

*Assistant Professor of Mechanical Engineering, University of Michigan, Ann Arbor, Mich.

Three German Books.

NEUE VERSUCHE AN EISENBETON-BALKEN UEBER DIE LAGE UND DAS WANDERN DER NULLINIE UND DIE VERBIEGUNG DER QUERSCHNITTE; VERSUCHE UEBER REINE HAFTFESTIGKEIT.—By Richard Müller. Berlin, Germany: Wilhelm Ernst & Sohn. Cloth; 7¼ × 10½ ins.; pp. 87; 37 plates and 39 text illustrations. 7½ marks; American price, $3.

ENTWURF EINES WASSERKRAFTWERKES IM GEBIET DER MURG OBERHALB FORBACH.—By Th. Rehbock, Professor in the Grand-ducal Technical College "Fridericiana" at Karlsruhe. Leipzig, Germany: Wilhelm Engelmann. Stiff paper; 8¼ × 13 ins.; pp. 47; 22 plates and 2 text illustrations. 8 marks; American price, $3.20.

DIE PORTLAND-ZEMENT-FABRIKATION.—Ein Handbuch für Ingenieure und Zementfabrikanten. By Carl Naske. Second edition, revised and enlarged. Leipzig, Germany: Theod. Thomas. Paper; 7 × 10¾ ins.; pp. 410; 2 plates and 359 text illustrations. 17 marks; American price, $6.80.

The wide range of variation in physical character by which reinforced concrete is distinguished, in conjunction with the numerous unsolved or doubtful questions concerning its behavior, gives opportunity to find something new in every experimental study. So also in the doctor-thesis experiments published under the title "New Tests of Reinforced-Concrete Beams." The chief object of study here was the position of the neutral axis and the distortion of initially plane cross-sections. Several interesting methods of measurement were employed; one of them was to photograph the side of a beam twice on the same plate, before and after deflection, measuring on the photograph the mutual displacement of cross lines drawn on the beam, which not only permitted accurate measurement, but also furnished a permament record subject to remeasurement at any time. The results obtained by the author are perhaps not very weighty, the series of tests being very small, but there are several stimulating suggestions in the results as well as in the methods.

The proposed 80,000-HP. hydraulic power development at the boundary of Baden and Wurttemberg, which will be the largest in Europe, is interesting because it contemplates the complete exploitation of the fall section of a river. It includes the development of several tributary streams by high dams feeding through tunnel pipe lines to the main power plant, and what is more interesting still, the excess power from the small-capacity intake on the main stream is to be stored by pumping water up to the storage reservoirs on the tibutaries. The net head obtained from the main stream is about 480 ft., that from the tributaries about 1,140 ft. Impulse wheels furnish the power, and high-head turbine pumps driven by induction motors operate the water-saving pumping plant. The cost of the power obtainable (mean annual output) is figured at from ¼ to ¾ ct. per KW.-hr.

The second edition of "Portland Cement Manufacture" finds the German industry approximating much nearer to the American type than was the case six years ago, when the first edition appeared. The rotary kiln has come into wide use in the interval. Correspondingly the author is able to take his examples largely from German practice, though America is by no means wholly neglected. The book, it should be remarked, describes the machinery and manipulations of cement making rather than its chemistry. There is a useful appendix on cement tests and on the standards of different countries.

On Certain Mechanical Appliances.

THE MECHANICAL APPLIANCES OF THE CHEMICAL AND METALLURGICAL INDUSTRIES.—A Complete Description of the Machines and Apparatus Used in Chemical and Metallurgical Processes for Chemists, Metallurgists, Engineers, Manufacturers, Superintendents and Students. By Oskar Nagel, Ph.D., Consulting Chemical Engineer. New York: The Author (P. O. Box 385). Cloth; 6 × 9½ ins.; pp. 311; 202 illustrations in the text. $2, net; English price, 8s. 6d., net.

The author approaches his subject from the standpoint of the buyer or user rather than that of the builder or the designer. It considers the principles of operation of the appliances treated and their suitability for different purposes, and does not enter into an intimate discussion of their design or construction. Its value is mainly descriptive.

The first half of the volume is devoted to appliances not inherently peculiar to the chemical and metallurgical industries. This portion deals with steam, water, gas and electric prime movers, and with systems of conveying solids, liquids and gases. The second half takes up grinding, mixing and separating machines, furnaces, gas purification, evaporating, distilling, condensing and drying appliances and temperature measurement. An abstract from a paper on "The Works Chemist as Engineer," read by Oscar Guttmann before the Society of Chemical Industry, is introduced as an appendix.

The first chapter, for some obscure reason, is entitled "General," and is made up of descriptions of the various forms and uses of pipe-covering, packing, valves and other fittings. The title of the second chapter, "Steam and Water Power," may likewise be misleading. The bulk of this chapter consists of information concerning boilers, feed water and the steam calorimeter, taken from a book published by a prominent boiler manufacturer; four or five pages give general descriptions (which are really little more than lists of the various parts) of a steam engine, and of the Parsons steam turbine. Water-power is briefly disposed of in a few paragraphs containing remarks about the Pelton wheel. The chapter on "Electric Power" is an exposition of the advantages of electrical power transmission for industrial plants.

In several instances the author has gone too far in the expression of sweeping and general opinions as though they were well acknowledged or authenticated facts. In Chapter V., for example, referring to the Renold silent chain, appears the statement that "the most extensive use of this chain in America has been on drives of motor vehicles, and Chapter IV. in its opening sentence informs the reader that "as a means of power supply for practically every purpose, the electric motor drive stands pre-eminent." The last quotation appears to have been evolved in the agony of getting started on the subject of "Electric Power," and, together with many others of a like nature, might better have been omitted.

The book as a whole is well arranged and well written, and the explanations are reasonably clear and concise. It will be of value to anyone wishing to get an idea of the arrangement and operation of any of the numerous appliances described.

STATE ENGINEER OF CALIFORNIA.—Report, May 11, 1907, to Nov. 30, 1908. (Nathaniel Ellery, State Engineer.) Sacramento, Cal.: Pub. Doc. Paper; 5¾ × 9 ins.; pp. 213; plates and text illustrations.

A variety of classes of engineering work which had previously been carried on independently have recently been brought together under the charge of a California Department of Engineering. The operations of this department since consolidation are here reported on. They relate to roads, rivers—including in the latter debris-restraining works; also water-supply and other investigations carried on in conjunction with the U. S. Geological Survey, and a variety of public buildings. The Engineering Department comprises an advisory board composed of the Governor of the State, the President of the State Board of Harbor Commissioners, the General Superintendent of State Hospitals, and the State Engineer. Working with this body is a river consulting board. The office force includes the State Engineer and State Architect, and various assistants.

Steinmetz on Electrical Engineering.

GENERAL LECTURES ON ELECTRICAL ENGINEERING.—By Charles Proteus Steinmetz, Ph. D., Past President Am. Inst. E. E., Consulting Engineer of the General Electric Co., Professor of Electrical Engineering in Union University, Author of "Alternating Current Phenomena," etc. Edited by Joseph LeRoy Hayden. Schenectady, N. Y.: Robson & Adee. Cloth; 6 x 9¼ ins.; pp. 284; 48 illustrations in the text. $2.

These lectures are broad pen pictures of the developments of theory and practice in electrical engineering, by one generally recognized as peculiarly fitted to undertake such a task. The work is essentially, though not entirely, non-mathematical. The more mathematical parts will be puzzling, to say the least, to the ordinary student or reader, though their import will be recognized by those engineers or teachers who, being familiar with that work, do not need to profit thereby. The trouble seems to lie in insufficient explanation of the symbols used and in confusion in the use of lower-case and capital letters as symbols.

The book is divided into 19 parts, 17 of which are lectures given at Union University. The remaining two sections, though called appendices, are papers read elsewhere.

The first lecture gives a broad survey of the industrial application of electric power, under the main divisions of (1) traction, (2) electrochemistry, and (3) lighting and stationary mechanical power. The succeeding lectures expand this treatment. The second and third take up the distribution of current, with particular reference to the comparative economy of ordinary and multi-wire systems. In the fourth lecture the factors making up the cost of power supply are analyzed.

The next four lectures are on high tension phenomena: Long distance transmission; resonance with abnormal voltage and current; high-frequency harmonics in waves of voltage and their influence in producing abnormal voltages in power and lighting circuits; high-frequency oscillations, induced by sudden changes in circuit conditions; the interchange of electro-static and magnetic distribution of energy. In Lecture 6, where the author takes up the inherent higher-frequency harmonics of voltage curves of generators and transformers, he writes of "constant-potential and constant-current harmonics." It can only be expected that these terms will be more or less meaningless without better defination to persons not familiar with the design of alternating current machinery and circuits.

Lectures 8 to 10 give a brief comparison of prime movers and discuss the operation of various generators and motors. Lecture 11, with Appendix 2, will be found an illuminating and interesting history of the development of lightning-protection apparatus. The twelfth, thirteenth and fourteenth lectures are on electric railroading, paying particular attention to the effect of direct and alternating-current motor characteristics on train service. Lecture 15 is on commercial electrolytic and electro-thermal processes.

Lectures 16 and 17 describe the important electric lighting systems and should be read with Appendix 1, which is a clear exposition of the aims and methods of "illuminating engineering."

WATER AND SEWAGE PURIFICATION PLANTS IN OHIO.—Report of an Investigation Made under Authority of an Act of Legislature, passed Feb. 23, 1906. (Dr. C. O. Probst, Secretary State Board of Health.) Columbus, Ohio; Pub. Doc. Cloth; 6½ x 9¾ ins.; pp. 888; folding and other plates, text illustrations and tables.

Under specfic legislative authority the Ohio State Board of Health has made a detailed investigation of water and sewage-purification plants, both public, institutional and private, within the borders of the state. The report before us includes descriptions of all these plants, taking up their history, engineering features, and methods and results of operation. Included in "Results" are copies of analytical and cost figures. These figures are quite extensive in some cases and relatively meager in others, but altogether constitute a valuable feature of the report. In addition to the detailed descriptions there are summary statements regarding both water and sewage purification. An abstract of these statements was given in Engineering News, of April 9, 1908. The whole work was carried out under the direction of Dr. C. O. Probst, Secretary of the Board. Mr. R. Winthrop Pratt, Chief Engineer of the Board, had general supervision of the engineering work, and contributes to this report the general reviews mentioned. The examination of water-purification plants was made and the report on that subject written by Mr. Philip Burgess, Special Assistant Engineer. In like manner, Mr. A. Elliott Kimberly handled sewage-purification plants, including supplementary reports on the disinfection of sewage effluents and on the purification of acid iron wastes at Shelby. Mr. Kimberly also contributes to the volume a special report on the water softening plant at Oberlin. Even were not the report printed in a somewhat small (though readable) type, its nearly 900 pages of text and illustrations would go far ahead of anything that has yet been done at any one time by any other State in the way of reporting on its water and sewage-purification plants. The commendable descriptions of sewage-purification works in the State of New York, published in the last report of the New York State Department of Health (see p. 20, Engineering Literature Supplement, Feb. 18, 1909), filled only 100 pages or so, for which relatively large type was used.

The Chances for More Portland Cement Plants.

THE PORTLAND CEMENT INDUSTRY FROM A FINANCIAL STANDPOINT.—By Edwin C. Eckel. New York: Moody's Magazine. Cloth; 6 x 9¼ ins.; pp. 93; one folding map and four diagrams in text. $2, net.

In the United States there are at present, or were a few months ago, when the figures were compiled, 113 Portland cement plants with a total annual capacity of about 85,000,000 bbls. In the year 1907 these plants produced less than 49,000,000 bbls. of cement. Furthermore, the statistics for 1908, not yet fully compiled, seem to show that the production for the latest year has decreased—a decided novelty in the heretofore rapidly-growing cement industry. In view of these facts the need for new cement plants is hardly apparent and certainly the financial success of such plants, in competition with well-established mills, is extremely doubtful. However, the cement plant promoter is probably still abroad in the land and the average banker and broker is doubtless still importuned to subscribe for stocks and bonds of well-advertised cement properties, in which time is claimed to be the only element necessary to create wealth.

It is for the benefit of such bankers and other investors that Mr. Eckel has written this book. Preceded by just enough technical information to inform the non-technical man of the nature of cement and of its processes of manufacture, the main discussion treats of the financing of cement mills, largely by sarcastic references to obviously get-rich-quick enterprises which have been foisted on the public of late. After this exposé of the flimsy financial foundation of most of the claims made by new companies, the author enters into a discussion of the rightful financial basis for a cement mill and shows, by the example of some successful companies, just what profits may reasonably be expected from a well-managed concern.

There is no attempt made to explain the costs of building or running a mill or to detail the technical side of such construction or maintenance. The book is purely and simply for prospective future investors, and as such it will probably be much appreciated. The only criticism that may be made, and that can only be from the standpoint of the promoter who is trying to establish his financial basis, is that the author seems to be holding a brief for the established interests; his whole attitude is one of discouragement of new plants, a very obvious desire on the part of those who are already in the business. As we noted at the beginning of this review, the construction of new plants seems hardly financially advisable, still the map published as a frontispiece to Mr. Eckel's book shows large blank spaces in the western part of this country where a cement plant might find a market which could be held even against the competition of older but more distant mills.

BRENNAN'S HANDBOOK.—A Compen[illegible] of Useful Legal Information for Business M[illegible] By B. A. Brennan, Contract Manager of the W[illegible]house Machine Co., Pittsburg, Pa. New Yo[illegible] John Wiley & Sons. London, England: Chapm[illegible] Hall, Ltd. Leather; 4 x 7 ins.; pp. 571. $5, net [illegible]English price, 21s., net.

The author in the preface to his [illegible] says:

> The compilation of this handbook was [illegible]sioned primarily by my effort to arrange a compact [illegible] systematic compendium of useful legal information [illegible] ready reference in connection with my duties as C[illegible]ct Manager of the Westinghouse Machine Co.

This avowed intention and the po[illegible]on of the author explain quite clearly the scop[illegible] the book. It is an abstract of business law [illegible] business men, particularly for those business [illegible] who are connected with the selling end of lar[illegible] manufacturing and engineering firms. It t[illegible]ches but lightly on the general principles of co[illegible]racts, devotes somewhat more attention to th[illegible]details of sales contracts and then passes to [illegible] extended description of various legal instrum[illegible]s which are common in business, such as d[illegible]s, mortgages, liens. Chapters on financial [illegible]per, acknowledgments, power of attorney, g[illegible]arantees, etc., are followed by synopses of the va[illegible]ous statutory requirements on conditional sales, chattel mortgages, mechanic's liens, bills and notes and collection laws. Finally there are a number of legal forms which should prove useful. A very complete index adds considerably to the value of the book.

LAW AND BUSINESS OF ENGINEERING AND CONTRACTING.—With Numerous Forms and Blanks for Practical Use. By Charles Evan Fowler, M. Am. Soc. C. E. New York: McGraw Publishing Co. Cloth; 5¾ x 9 ins.; pp. 162; text illustrations. $2.50, net.

The larger portion of the matter in this book is a development of a course of lectures by the author to the engineering students of the University of Washington. As a result of the rather personal nature of such lectures, the treatment of the subject in the book is more colloquial than is usually found in treatises on contracts and specifications. These lectures, however, have been supplemented with examples of model contracts and specifications so as to make a more specific treatment than is possible in a classroom. In addition there are chapters upon methods of estimating and bidding on work and upon the organization of contracting companies.

The book is not an extended treatise on specifications or contract law, but rather an instruction book to young engineers regarding the difficulties that beset contract work and the methods to avoid them.

THE INTERPRETATION OF TOPOGRAPHIC MAPS.—By Rollin D. Salisbury and Wallace W. Atwood. Professional Paper 60, U. S. Geological Survey; George Otis Smith, Director. Washington, D. C.: Pub. Doc. Paper; 9 x 11½ ins.; pp. 84; 170 plates and 34 text figures.

By means of over 170 specimen maps and photographs the authors of this rather bulky government document have illustrated the educational value of the well-known topographical maps that are being issued by the U. S. Geological Survey. Each map is accompanied by text which explains some special feature that this particular map best illustrates, and thus the many advantages to be derived from a study of these excellent surveys may be appreciated. Although intended more specifically for teachers of geography, geology and topography, a study of the book will repay any one who is interested in the natural features of his country.

STATE ENGINEER AND SURVEYOR OF THE STATE OF NEW YORK.—Annual Report for the Fiscal Year Ending Sept. 30, 1907. (Frederick Skene, State Engineer and Surveyor.) Albany, N. Y.: Pub. Doc. Cloth; 5½ x 9 ins.; pp. 636; numerous plates and tables, and two folding maps in pocket.

Aside from matters of routine administration, this report is chiefly interesting for its illustrated description of progress, up to the summer of 1907, on the great New York State Barge Canal.

MESSAGE OF HON. GEORGE B. McCLELLAN, THE MAYOR, TO THE BOARD OF ALDERME[illegible] (New York).—New York: Pub. Doc. Stiff paper; [illegible] x 10¾ ins.; pp. 134; numerous folding and other [illegible]lates.

The final message of Mayor McClellan [illegible] four-year term presents by the aid of handson[illegible] typography, illustrations and presswork a so[illegible]ewhat comprehensive review of what has be[illegible] attempted and achieved during his term o[illegible] service. A large number of half-tones are included.

Johnson's Railway Transportation Revised.

AMERICAN RAILWAY TRANSPORTATION.—By Emory R. Johnson, Ph. D., Professor of Transportation and Commerce in the University of Pennsylvania, Author of "American and Inland Water Transportation." Second edition, revised. New York: D Appleton & Co. Cloth; 5¾ × 8¼ ins.; pp. 434; folding and other plates, and text illustrations. $1.50.

We are very glad to see that the demand for Professor Johnson's excellent work has made necessary the publication of a third edition. In view of the great activity in railway legislation during the past few years, and the heated discussion of the subject of railway regulation in legislatures, newspapers and courts, it is of great value to have such an authoritative and unprejudiced work as this of Professor Johnson.

We think that even those who have closely followed the proceedings of Congress and of state legislatures during recent years will be surprised to see what progress has been made in establishing state and federal control. And this control seems likely to be exercised in the future through commissions rather than by direct legislative acts.

A current example of this which comes to our notice at this time is the defeat in Indiana of a law requiring all locomotives to be fitted with headlights of a certain candle power. The probabilities seem good that the law was promoted by some concern interested in securing the introduction of electric headlights. It was defeated on the sound ground that all such regulation should originate with the State Railway Commission, and not with the legislature.

We are rather surprised to see in the chapter on State Railway Commissions that no mention is made of the New York Public Service Commission Law, and the enlarged powers of control which were granted under it. This law is serving as a model for legislation in numerous other states, and seems likely to be an important step forward in state regulation of monopolies.

In the above brief review, we have referred to the concluding portion of the work, devoted to the relation between the railways and the state; but it should be understood that the scope of the book is much broader. The opening chapters are devoted to a description of the American railway system, with much interesting historical matter. Then follows an account of the railway service, including that of freight, passengers, express and mail; with the general organization and the system of records in use. Then comes a complete section devoted to the relations between the railways and the public. It may be added that the price of the book is exceedingly low for a work containing such a large amount of valuable matter, and one which is of such usefulness as a work of reference.

REPORT ON THE INDETERMINATE FRANCHISE FOR PUBLIC UTILITIES.—Submitted Dec. 29, 1908, by Milo R. Maltbie, Commissioner. New York: Public Service Commission for the First District (154 Nassau St.). Paper; 5¼ × 9 ins.; pp. 34.

A long-time and thorough student of franchises and other municipal affairs before becoming a member of the Public Service Commission, Mr. Maltbie has since had special opportunity and occasion to continue his studies and practical observations. He here states the principles which should be observed in framing franchises, then outlines the nature of and objections to both perpetual and short-term franchises. The indeterminate franchise—"tenure during good behavior"—is then considered at length, both in theory and practice—the latter including a review of actual experience in Massachusetts, the District of Columbia, Wisconsin, and New York City itself.

A pamphlet of 144 pages, accompanied by a large album of 22 plates, all relating to the construction of the new Mytishzinsk Aqueduct at Moscow, has been received from Mr. Nicholas P. Simin, Chief Engineer of the Moscow Water-Works. The text matter is in Russian. It reviews work carried on from 1897 to 1906, and describes two pumping plants and the construction of some conduits. Detailed cost figures are given, and also contract specifications for pumping machinery and cast-iron pipe.

A LIST OF THE BEST

ENGINEERING BOOKS

for your convenience

Law and Business of Engineering
and Contracting. By CHAS. E. FOWLER. Contains numerous blank forms for practical use.
171 pages. Price, $2.50, net.

Heat Energy and Fuels
Pyrometry, Combination, Analysis of Fuels and Manufacture of Charcoal, Coke and Fuel Gases. By H. v. JUPTNER. Tr. by Oskar Nagel.
306 pages, 118 illustrations, 138 tables. Price, $3.00, net.

Water Power Engineering
The Theory, Investigation and Development of Water Powers. By DANIEL W. MEAD, Professor of Hydraulic and Sanitary Engineering, University of Wisconsin.
803 pages, 413 illustrations, numerous tables. Price, $6.00, net.

Hydroelectric Plants
Design and Construction, with special reference to the design of dams. By R. C. BEARDSLEY.
520 pages, 68 tables, 471 illustrations. Price, $5.00, net.

Hydroelectric Developments
A brief, general treatment of the commercial side of the question. By PRESTON PLAYER.
70 pages, 3 diagrams. Price, $1.00, net.

Steam Power Plants
Their Design and Construction. By HENRY C. MEYER. Second edition, corrected.
100 pages, 16 plates, 63 illustrations. Price, $2.00, net.

Pumping Engines
For Water Works. By CHARLES ARTHUR HAGUE. The best book on the subject in print.
416 pages, 113 illustrations, 28 plates. Price, $5.00, net.

Practical Irrigation
Its Value and Cost. Includes 100 tables of various data valuable to the farmer and engineer. By AUGUST J. BOWIE, Jr.
252 pages, 53 illustrations. Price, $3.00, net.

Types and Details of Bridge Construction
By FRANK W. SKINNER.
Vol. I.—Arch Spans. 301 pages, 300 diagrams and illustrations. Price, $3.00, net.
Vol. II.—Plate Girders. 424 pages, 300 diagrams and illustrations. Price, $4.00, net.
Vol. III.—Specifications and Standards for Short Railroad Spans. 307 pages, 142 illustrations. Price, $3.00, net.

Properties of Steel Sections
A reference book for structural engineers and architects. By JOHN E. SAMPLE.
121 pages, 50 tables. Price, $3.00, net.

Mathematical Handbook
Containing the chief formulas of algebra, trigonometry, calculus, and analytical geometry, together with many mathematical tables. By EDWIN P. SEAVER.
290 pages, 1920 formulas, 75 pages of tables. Price, $2.50, net.

Beams, Channels and Reactions
A series of 25 plates of curves for calculating same. By SIDNEY DIAMANT. A time-saver for the engineer.
40 pages. Price, $2.00, net.

Cement and Concrete
Manufacture, Properties and Testing. By LOUIS C. SABIN. Second edition, revised and enlarged.
584 pages, 161 tables of tests. Price, $5.00, net.

Hot Water Heating and Fitting
Modern Hot Water Apparatus, the Method of Their Construction and the Principles Involved. By WM. J. BALDWIN.
Fourth Edition, revised and enlarged; 322 pages, 213 illustrations. Price, $4.00, net.

Steam Heating and Ventilation
A Scientific Treatment. By WILLIAM S. MONROE.
150 pages, 90 illustrations. Price, $2.00, net.

Handbook of Mathematics
For engineers and engineering students. By J. CLAUDEL. Translated by O. A. Kenyon. Particularly adapted for reference work.
708 pages, 422 illustrations. Price, $3.50, net.

The Plane Table
And Its Use in Surveying. By W. H. LOVELL, Topographer, U. S. Geological Survey.
50 pages, illustrated. Price, $1.00, net.

Drawing Instruments
Their Use and Abuse. A manual for engineers and engineering students. By WALTER G. STEPHAN
112 pages, 74 illustrations. Price, $1.00, net.

Spiral Tables
Prepared for the Canadian Pacific R. R. By J. G. SULLIVAN.
47 pages, 20 tables. Flexible morocco. Price, $1.50, net.

The Transition Curve
or Curve of Adjustment, * * * by a Method of Rectangular Coordinates and Deflection Angles. By N. B. KELLOGG.
75 pages. Morocco. Price, $1.75, net.

Automatic Block Signals
And Signal Circuits. By RALPH SCOTT. Treats the various types and describes apparatus of different manufacturers.
252 pages, 220 illustrations. Price, $2.50, net.

Standard Handbook for Electrical Engineers
Second Edition, 1908. Tenth Thousand.
Flexible morocco binding with THUMB INDEX; 1,300 pages, 1,300 illustrations. Price, $4.00, net.

Social Engineering
By WM. H. TOLMAN.
Introduction by ANDREW CARNEGIE.
400 pages, 57 illustrations. Price, $2.00, net.

Internal Combustion Engines
A reference book for Designers, Operators, Engineers and Students. By WM. M. HOGLE, S. B.
271 pages, 106 illustrations, 21 tables. Price, $3.00, net.

We will send FREE circulars of any of the above; copies of our special lists on Turbines, Electric Railways, Cement and Concrete or Wireless Teleg. raphy. Write for catalog.

McGRAW PUBLISHING COMPANY

239 West 39th Street **New York**

ILLUSTRATED TECHNICAL DICTIONARY.—In Six Languages: English, German, French, Russian, Italian, Spanish. Edited after a novel method by K. Deinhardt and A. Schlomann, Engineers. New York: McGraw Publishing Co. London: Archibald Constable & Co., Ltd. Munich-Berlin: R. Oldenbourg. Paris: H. Dunod & E. Pinat. St. Petersburg: K. L. Ricker. Milan: Ulrico Hoepli. Madrid: Bailly-Bailliere é Hijos. Cloth; 4 × 7¼ ins.

Vol. II.: Electrical Engineering, Including Telegraphy and Telephony. Compiled by Charles Kinsbrunner, Assoc. M. Inst. E. E., Consulting Electrical Engineer. Pp. 2,100; 4,000 text illustrations and numerous formulas. $7.

Vol. III.: Steam Boilers, Steam Engines, Steam Turbines. Compiled by Wilhelm Wagner. Pp. 1,322; 3,500 text illustrations and numerous formulas. $4.

Vol. IV.: Internal Combustion-Engines. Compiled by Karl Schikore. Pp. 618; 1,000 text illustrations and numerous formulas. $3.

The first volume of this series of novel dictionaries, "Machine Details and Tools," appeared in 1906, and now three of the ten additional volumes promised are at hand. (See this supplement, June 14, 1906, for notice of the first volume.) The work is in six languages throughout; English, German, French, Russian, Italian and Spanish. The arrangement is not alphabetical in any one language, but is arranged in topical groups and sub-groups, which are best located by the table of contents. At the end of each volume is an alphabetical index in each of the six languages. The center of each page is left for pictures of the apparatus or ideas defined. On the right of this cut, or blank space when no cut is possible, are the Russian, Italian and Spanish terms and on the left are the German, English and French. There are some eight to twelve topics on each page.

Volume II. subdivides the field of electrical engineering into the following subjects, given in their respective order: batteries, boilers and engines, machinery, switching apparatus, instruments, stations, circuits, house installation, lighting, lightning, telegraphy, telephony, electrochemistry, electro-therapeutics and units.

Steam engineering, in Vol. III., is divided into fuels, heat production, furnaces, heat transmission, evaporation, materials of construction, boilers, feed apparatus, superheaters, piping, theory of steam engines, engine parts, condensers, engine types, engine erection, engine working, theory of turbines, turbine parts and plants, in the order given.

The volume on "Internal-Combustion Engines" (No. III.) is the smallest of the three new ones and is divided into sections on gases and oils, theory of internal-combustion engines, materials and construction of engines, engine erection, complete plants, testing and economics.

It seems necessary in using these dictionaries to best advantage first to acquire a general familiarity with the scheme of arrangement. After this is done they should be of no little service to engineers working in these languages.

INDUSTRIAL-SOCIAL EDUCATION.—By William A. Baldwin, Principal of the State Normal School, Hyannis, Mass. Assisted by Mrs. Baldwin and Members of the Faculty. Springfield, Mass.: Milton Bradley Co. Cloth; 6¾ × 9½ ins.; pp. 147; plates and text illustrations. $1.50.

There is here set forth in an interesting way an account of one of the many attempts now being made in various parts of the country to bring primary and secondary education more into line with the nature of the live boy and girl, and with his or her probable life work. The introductory chapters of this book discuss educational problems in some of their broader phases and from the point of view just indicated. The conclusion is that the natural desire of every normal child to do things should be recognized in school instruction, and that the things done should be useful. Accordingly, the Hyannis Normal School for a few years past has been teaching children to make various useful articles and to do useful garden work. The things made or raised are sold and the children share in the income gained, thus, as anybody can see, greatly stimulating their interest in their work.

The principles and general practice of industrial-social education having been set forth, there follow a number of chapters on basket work, hammock-making, gardening, weaving and other useful industries, and how to teach them. A considerable amount of space is given to gardening.

Send for New Catalog of These 30 Books

BERG, "Timber Test Records"..... $0.50
FALK, "Cements, Mortars and Concretes"..... 2.50
Fish, "Mathematics of Paper Location of a Railroad"..... .25
GILBRETH, "Field System"..... 3.00
GILLETTE, "Handbook of Cost Data"..... 4.00
"Rock Excavation, Methods and Cost"..... 3.00
GILLETTE and HILL, "Concrete Construction, Methods and Cost"..... 5.00
HEIDENREICH, "Engineer's Pocketbook of Reinforced Concrete"..... 3.00
INSKIP, "Tables of Logs and Squares"..... 3.00
KINDELAN, "Trackman's Helper"..... 1.50
LAVIS, "Railroad Location Surveys and Estimates"..... 3.00
LOVELL, "Practical Switchwork"..... 1.00
MAYER, "Telephone Construction, Methods and Cost"..... 3.00
McCULLOUGH, "Engineering Work in Towns and Cities"..... 3.00
"Reinforced Concrete, A Manual of Practice". 1.50
REID, "Concrete and Reinforced Concrete Construction"..... 5.00
REUTERDAHL, "Theory and Design of Reinforced Concrete Arches"..... 2.00
SMITH, "Maintenance of Way Standards on American Railroads"..... 1.50
"Railway Curves for Practical Trackmen"... 1.00
"Standard Turnouts on American Railroads". 1.00
TAYLOR, "Practical Cement Testing"..... 3.00
TAYLOR, "Surveyors' Hand Book"..... 2.00

In Preparation—Ready Soon

DODGE, "Diagrams for Designing Reinforced Concrete Structures."
FRYE, "Pocket Book for Civil Engineers"....$5.00
GILBRETH, "Bricklaying System"..... 3.00
GILLETTE and DANA, "Cost Keeping and Construction Economics."
GILLETTE and HAUER, "Earth Excavation and Embankments—Methods and Cost".... 5.00
McCULLOUGH, "Engineering Contractors' Hand Book."
PECKHAM, "Solid Bitumens: Their Physical and Chemical Analysis, Together with a Treatise on the Chemical Technology of Bituminous Pavements."
SEELY, "How to Become an Inspector on Public Work."
SLIPPY, "Economics of Telephone Cable Work."

All the above books are our own publications. The prices are all net, postpaid. Send for tables of contents and sample pages of any of these books.

THE MYRON C. CLARK PUBLISHING CO.
357 Dearborn Street, Chicago, Ill.

SAXTON'S
Logs for Four-Plac Work
Table & Text

A book which should popularize l hms even among those who have never avail their aid before.

Its novel features are: A double, ginal, exposed Index from which the logs of place and two-place numbers are read witho ning the book, and by means of which the is opened DIRECTLY—with *no* fumbling—to an g in the Table; a Table of superior legibility h shows in parallel columns Number, Logar of the number, and Log of the Reciprocal and a Text (illustrated by numero number; which the author believes he may examples) his novelties because he has never among like it. The "novelty" here is in the anything simplicity" of operations resulting f notonous use of the too-much neglected Recipr the free body "knows about" reciprocals, and Every- them, but until they are furnished re to make that you can take the logs of multiplie made, so umn L and the logs of divisors from from col- you will hardly realize how nearly m umn R, operations can be made. The illustrati nical all vious advertisements will give some of pre- and the examples in the Text will car of this, viction that the right use of the four- the con- far more "mechanical" than the manip ace log is slide-rule, and may be said to require tion of a effort after the problem is stated. no mental

The Text, by the bye, is a practical c instruction sufficient for those who know nothing, theoretically, of logarithms. In runnin on sixty examples all necessary rules are se of in- comments clearly stated. The *theory* has been omitted, as within reach everywhere. There is not much of it, and most people have it—or enough of it for practical purposes.

Remember that for the larger part, by far, of all of the computations of the Engineer, Architect or Contractor Four-place Work with Four-place Logs leaves nothing to be desired.

Size 11 × 8¾; superior paper and large, clear type; morocco binding.

Nothing has been spared in the endeavor to make an IMPLEMENT in every way adapted to its purpose, which is to make four-place work "as easy as rolling off a log" and rolling off logs easier than ever before.

$3.00 by mail
WRITE FOR A CIRCULAR
Address, E. SAXTON
841 Bladensburg Road
WASHINGTON, D. C.

JUST PUBLISHED
Law and Business of Engineering and Contracting
With Numerous Forms and Blanks for Practical Use

By CHARLES EVAN FOWLER, C. E., Author of "Ordinary Foundations"

CHAPTER I.—Relation Between the Engineer and Contractor. II.—Ordinary Forms of Contracts. III.—Ordinary Specifications. IV.—Special Forms of Specifications. V.—Special Forms of Contracts. VI.—Inspection of Engineering Work. VII.—Estimating Materials and the Costs of Engineering Structures. VIII.—Bidding on Engineering Work. IX.—Organization of Contract Work. X.—Essentials of Contract Law.

171 pages, Price, postpaid, $2.50 Net

Send for special circular. We can supply any engineering book.

McGRAW PUBLISHING COMPANY
Publishers, Importers, Booksellers
239 West 39th Street - - New York

Two *high class magazines for the price of* **One**

The Review of Reviews
($3.00 a Year)
and
The Engineering Digest
($2.00 a Year)

Cover the Fields of

Engineering, Applied Science, Politics, Religion, Art and General Literature

and are indispensable to the busy engineer and commercial man

OUR PRICE FOR BOTH
$3.00 A YEAR

Address all orders to
THE ENGINEERING DIGEST
St. Paul Bldg., New York

WATER POWER ENGINEERING

By DANIEL W. MEAD, Professor of Civil and Sanitary Engineering, University of Wisconsin

CONTENTS: I.—Introduction. II.—Power. III.—Hydraulics. IV.—Water Power. V.—Water Power (Continued). VI.—Rainfall. VII.—The Disposal of the Rainfall. VIII.—Run-off. IX.—Run-off (Continued). X.—Stream Flow. XI.—The Measurement of Stream Flow. XII.—Water Wheels. XIII.—Turbine Details and Appurtenances. XIV.—Hydraulics of the Turbine. XV.—Turbine Testing. XVI.—The Selection of the Turbine. XVII.—The Load Curve and Load Factor, and Their Influence on the Design of the Power Plant. XVIII.—The Speed Regulation of Turbine Water Wheels. XIX.—The Water Wheel Governor. XX.—Arrangement of the Reaction Wheel. XXI.—The Selection of Machinery and Design of Plant. XXII.—Examples of Water Power Plants. XXIII.—The Relation of Dam and Power Station. XXIV.—Principles of Construction of Dams. XXV.—Appendages to Dams. XXVI.—Pondage and Storage. XXVII.—Cost Value and Sale of Power. XXVIII.—The Investigation of Water Power Projects. Appendix.—a. Water Hammer. b. Variations of v, h, and Power in a Plant with a Closed Penstock. c. Test of a Horizontal Wheel with Umbrella Covering. Tables.

The book is one of the most complete treatises on an engineering subject published in this country, and will unquestionably be of value to any engineer engaged in water power development.—Eng. Record

803 Pages. 413 Illustrations. $6.00 net **Send for 8-page circular**

Published by the McGRAW PUBLISHING COMPANY 239 West 39th Street NEW YORK

Like oth normal schools, the one at Hyannis performs double function of teaching and teaching t teach. The influence of the school is thus be spread by means of both the pupils who have ceived their education there and the teachers after their period of training, scatter ov the country and take up educational work.

The bo may very properly be considered in connectio with the little volume and the series of paper on vocational or industrial education noticed i this supplement for Feb. 18.

SMOLEY'S TABLES.—Parallel Tables of Logarithms and Squares of Angles and Logarithmic Functions Corresponding to Given Bevels, Together with a Complete Set of Five-Decimal Logarithmic-Trigonometric Tables. For Engineers, Architects and Students. By Constantine Smoley. Fifth edition, revised. New York: The Engineering News Publishing Co. London, England: Archibald Constable & Co., Ltd. Flexible morocco; 4¾ × 7 ins.; pp. 448. $3.50, net.

This new edition of the well-known tables of squares and logarithms of foot-and-inch dimensions has been enlarged by adding (1) a multiplication table of rivet-spacing up to 30 spaces, for eighths of an inch from 1 in. to 6 ins.; (2) five-place logarithm tables of numbers and of trigonometric fractions, and (3) a table of the natural values of trigonometric fractions. The book becomes more bulky through the increase in contents, but not enough to become unhandy.

Publications Received.

AERIAL WARFARE.—By R. P. Hearne. With an Introduction by Sir Hiram Maxim. London, England: John Lane. New York: John Lane Co. Cloth; 5¾ × 9 ins.; pp. xxxix. + 237; 57 plates. $2.50, net.

AIDS TO SHIPPERS.—New York: Oelrichs & Co. (Forwarding Department). Boards; 6¾ × 9 ins.; pp. 62. Sent free on request.

ALTERNATING-CURRENT MACHINES.—Being the Second Volume of Dynamo Electric Machinery, Its Construction, Design and Operation. By Samuel Sheldon, Ph. D., D. Sc., Past-President Am. Inst. E. E., Professor of Physics and Electrical Engineering at the Polytechnic Institute of Brooklyn, and Hobart Mason, Assoc. Am. Inst. E. E., and Erich Hausmann, Assoc. Am. Inst. E. E., Instructor in Electrical Engineering at the Polytechnic Institute of Brooklyn. Seventh edition, completely rewritten. New York: D. Van Nostrand Co. London, England: Crosby Lockwood & Son. Cloth; 5 × 7¾ ins.; pp. 353; 236 illustrations in the text. $2.50, net.

AMERICAN RAILWAY BRIDGE AND BUILDING ASSOCIATION.—(Successor to the Association of Railway Superintendents of Bridges and Buildings.) Proceedings of the 18th Annual Convention, Held in Washington, D. C., Oct. 20-22, 1908. S. F. Patterson, Concord, N. H., Secy. Paper; 6 × 9 ins.; pp. 326; folding plates and text illustrations.

AMERICAN SOCIETY FOR TESTING MATERIALS.—Proceedings of the Annual Meeting Held at Atlantic City, N. J., June 23-27, 1908. Vol. VIII. Edited by the Secretary, under the Direction of the Committee on Publications. Philadelphia, Pa.: The Society (Edgar Marburg, University of Pennsylvania, Secy.). Paper 6 × 9 ins.; pp. 706; folding plates and numerous text illustrations.

THE ARMOUR ENGINEER.—The Semi-Annual Technical Publication of the Student Body of Armour Institute of Technology. Vol. I., No. 1, January, 1909. Paper; 6½ × 10 ins.; pp. 114; illustrated. 50 cts. per copy; $1 per year.

BOARD OF EXAMINERS OF ARCHITECTS (Illinois).—Sixth Biennial Report. The Law, Rules of the Board, and List of Licensed Architects. Chicago, Ill.: The Board (Peter B. Wight, Secy., 1112 Chamber of Commerce). Paper; 5¾ × 8½ ins.; pp. 60.

BOARD OF HARBOR AND LAND COMMISSIONERS (Massachusetts).—Annual Report for the Year 1908. (George E. Smith, Chairman.) Boston, Mass.: Pub. Doc. (No. 11). Paper; 5¾ × 9 ins.; pp. 68; folding and other plates.

BOARD OF RAILROAD COMMISSIONERS (Iowa).—Annual Report for the Year Ending June 30, 1907. (N. S. Ketchum, Chairman.) Cloth; 5¾ × 9 ins.; pp. 574; illustrated.

BOARD OF RAILROAD COMMISSIONERS (Massachusetts).—Annual Report, January, 1909. (Walter Perley Hall, Chairman, Fitchburg, Mass.) Boston, Mass.: Pub. Doc. (No. 14). Cloth; 5½ × 9 ins.; pp. xxxvi. + 391; two large folding maps.

BOARD OF STATE HARBOR COMMISSIONERS (California).—Biennial Report for the Fiscal Years Commencing July 1, 1906, and Ending June 30, 1908. W. V. Stafford, President Commissioners. Sacramento, Cal.: Pub. Doc. Paper; 5¾ × 9 ins.; pp. 91; folding plates.

BRITISH COLUMBIA.—Bulletins, Bureau of Provincial Information (R. M. Palmer, Secy.). Victoria, B. C.: Pub. Doc. Paper; 5¾ × 8¾ ins.

No. 10: Land and Agriculture in British Columbia. (8th edition.) Pp. 98; illustrated.

No. 22: New British Columbia. The Undeveloped Areas of the Great Central and Northern Interior. (9th edition.) Pp. 104; two large folding maps.

BULLETINS, U. S. GEOLOGICAL SURVEY.—George Otis Smith, Director. Washington, D. C.: Pub. Doc. Paper; 5¾ × 9 ins.

No. 354: The Chief Commercial Granites of Massachusetts, New Hampshire and Rhode Island. By T. Nelson Dale. Pp. 228; 9 plates and 27 text figures.

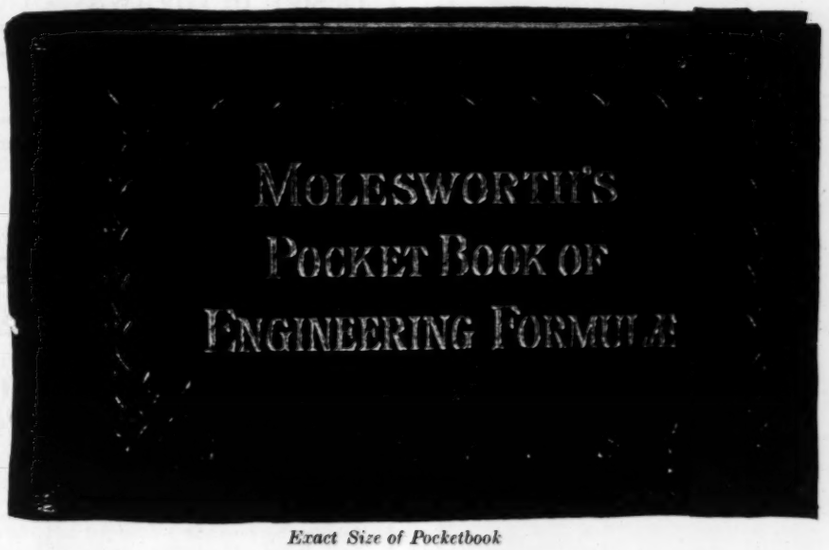
No. 363: Comparative Tests of Run-of-Mine and Briquetted Coal on Locomotives. Including Torpedo-Boat Tests and Some Foreign Specifications for Briquetted Fuel. By W. F. M. Goss. Pp. 57; 4 plates and 35 text figures.

A Book for the Pocket

The **26th Edition** of MOLESWORTH'S POCKET BOOK OF ENGINEERING FORMULAE is now ready, and orders will be filled promptly.

There has been a most careful and complete revision of this useful Pocket Book since the last edition was published and CIVIL, MECHANICAL and ELECTRICAL ENGINEERS will find it, as heretofore, *the best and only real Pocket Book.*

Price, $2.00 net.



Exact Size of Pocketbook

By Sir GUILFORD L. MOLESWORTH, K.C.I.E.

Assisted by { H. B. MOLESWORTH, M. Inst. C. E.
W. H. MOLESWORTH, M. Inst. E. E., M. Inst. M. E.

With an Electrical Supplement

SPECIAL OFFER—Upon receipt of $2.00 for a copy, we will STAMP YOUR NAME IN GOLD ON COVER, free of charge, and mail book to you postpaid.

SPON & CHAMBERLAIN

123 E.N. Liberty Street NEW YORK

JUST PUBLISHED

The Mechanical Appliances of the Chemical and Metallurgical Industries

By OSKAR NAGEL, Ph. D.

A detailed description of all machines, appliances and apparatus used in the chemical and metallurgical industries.

Table of Contents: I—General; II—Steam and Water Power; III—Gas Power; IV—Electric Power; V—Transportation of Solids; VI—Transportation of Liquids; VII—Transportation of Gases; VIII—Grinding Machinery; IX—Mixing Machinery; X—Firing and Furnaces; XI—Separating Appliances; XII—Purification of Gases; XIII—Evaporating, Distilling and Condensing; XIV—Dryers. Large octavo. 292 illustrations. Price $2.00 net. Sent anywhere on receipt of price.

OSKAR NAGEL, Ph. D.

P. O. Box 385 NEW YORK

DAM IT

with a structure that will be stable against all conditions, but read GODFREY'S CONCRETE ($2.50) to learn how that structure should be built. Colleges have already begun to revise their instruction in dams on account of agitation by this author. Read what made the QUEBEC BRIDGE fail (pamphlet, 20 cts.). Get the best book of structural tables and data in the English language, GODFREY'S TABLES ($2.50).

EDWARD GODFREY

Monongahela Bank Bldg., Pittsburg, Pa.

New Books of Special Interest to Engineers

By Thomas Conyngton, of the New York Bar

Corporate Organization

Enlarged Edition. Discusses in detail the formation of a corporation from selection of name and capitalization to complete organization; indicating the danger points and giving numerous and most valuable suggestions. Contains forms for subscription lists, charters, by-laws, option agreements, voting trust agreements, etc., etc. The most practical work of its kind. 400 pages, 6 × 9 inches, 1908. Buckram binding. Prepaid, $3.00.

Corporate Management

Third Edition. A practical work on the management of corporations, telling what to do and how and when. Treats of by-laws, stock, stockholders, directors, officers, regular and special meetings, minutes, corporate records, etc., etc. Contains over 200 forms used in corporate procedure. More largely used in the United States than any other similar work. 400 pages, 6 × 9 inches, 1906. Buckram. Prepaid, $3.00.

Send for circulars and list of business books.

THE RONALD PRESS COMPANY

Rooms, 90-92, 229 Broadway, New York

No. 365: The Fractionation of Crude Petroleum by Capillary Diffusion. By J. Elliott Gilpin and Marshall P. Cram, under the supervision of David T. Day. Pp. 33; 3 text figures.

No. 366: Tests of Coal and Briquets as Fuel for House-Heating Boilers. By D. T. Randall. Pp. 44; 3 plates and 2 text figures.

No. 367: The Significance of Drafts in Steam-Boiler Practice. By Walter T. Ray and Henry Kreisinger. Pp. 61; 26 illustrations in the text.

No. 368: Washing and Coking Tests of Coal at the Fuel-Testing Plant, Denver, Colo., July 1, 1907, to June 30, 1908. By A. W. Belden, G. R. Delamater and J. W. Groves. Pp. 54; two plates and three text figures.

BUREAU OF MINES (Ontario).—Annual Report, 1908. (Vol. XVII.) (Thomas W. Gibson, Deputy Minister of Mines.) Toronto, Ontario: Pub. Doc. Paper; 6½ × 9½ ins.; pp 356; folding plates and text illustrations.

BUREAU FOR THE SAFE TRANSPORTATION OF EXPLOSIVES AND OTHER DANGEROUS ARTICLES.—Report of the Chief Inspector, February, 1909. New York: Bureau of Explosives (24 Park Place). Paper; 7¼ × 10¼ ins.; pp. 71. $1.

CAR FENDER AND WHEELGUARD TESTS.—Report Submitted to the Public Service Commission for the First District, New York State, Dec. 29, 1908. (Reprinted from Proceedings of Dec. 29, 1908.) New York: The Commission (Travis H. Whitney, Secy., 154 Nassau St.). Paper; 6 × 9¼ ins.; pp. 17; folding and other plates. [See Eng. News, Feb. 25, 1909, for extracts from this report.—Ed.]

CHAUDIERES MARINES ET ACCESSOIRES.—Avec Notes de Résistance des Matériaux et de Thermodynamique. By L. Jauch and A. Masméjean, Professors in the Ecole des Mécaniciens at Toulon. Part I. Toulon, France: J. Aîté. Paper; 6½ × 9¾ ins.; pp. 521; 1 folding plate and 300 text illustrations; 37 plates in separate volume, 7¾ × 10¾ ins. 22 francs; American price, $6.00.

CHEMICAL AND BIOLOGICAL SURVEY OF THE WATERS OF ILLINOIS.—Report from Sept. 1, 1906, to Dec. 31, 1907. Edward Bartow, Director. University of Illinois Bulletin, Water Survey Series No. 6. Urbana, Ill.: The University. Paper; 6 × 9 ins.; pp. 88; illustrated.

COAST AND GEODETIC SURVEY.—Report of the Superintendent, Showing the Progress of the Work from July 1, 1907, to June 30, 1908. (O. H. Tittmann, Supt.) Washington, D. C.: Pub. Doc. Cloth; 8⅝ × 11⅛ ins.; pp. 169; nine folding sheets in pocket.

COST OF PUMPING FROM WELLS FOR THE IRRIGATION OF RICE IN LOUISIANA AND ARKANSAS.—By W. B. Gregory, Professor of Experimental Engineering, Tulane University of Louisiana. Bulletin 201, Office of Experiment Stations; A. C. True, Director. Washington, D. C.: Pub. Doc. Paper; 5¾ × 9 ins.; pp. 39; two illustrations in the text.

DENVER MUNICIPAL FACTS.—Issued Every Week by the City of Denver. Vol. I., No. 2, Feb. 27, 1909. Denver, Colo.: Compiler, Municipal Facts. Paper; 9 × 12¼ ins.; pp. 16; illustrated. Free on request.

DEPARTMENT OF PUBLIC WORKS (Saskatchewan).—Annual Report for the Financial Year 1907-8, Ending Feb. 29, 1908. (Walter Scott, Commissioner of Public Works.) Regina, Sask.: Pub. Doc. Paper; 6¾ × 10 ins.; pp. 248; plates and text illustrations.

DIRECTOR OF FORESTRY (Philippine Islands).—Annual Report for the Period July 1, 1907, to June 30, 1908. Major George P. Ahern, Director of Forestry. Manila, P. I.: Pub. Doc. Paper; 5¾ × 9 ins.; pp. 26.

DIRECTORY OF PORTLAND CEMENT MANUFACTURERS.—Together with Manufacturers of Gypsum and Lime. Corrected to Jan. 1, 1909. Chicago, Ill.: "The Cement Era." Flexible leather; 3 × 5 ins.; pp. 220. $1.

EXPORTERS' ENCYCLOPEDIA.—Fifth (1909) Edition. Containing Full and Authentic Information Relative to Shipments for Every Country in the World. New York: Exporters' Encyclopedia Co. Cloth; 5½ × 8¼ ins.; pp. 656. $5.

A FEW PERTINENT FACTS CONCERNING THE PHILIPPINE FORESTS AND NEEDS OF THE FOREST SERVICE, THAT SHOULD INTEREST EVERY FILIPINO.—Major George P. Ahern, Director of Forestry. Circular No. 3, Bureau of Forestry. Manila, P. I.: Pub. Doc. Paper; 5¾ × 9 ins.; pp. 21.

LA FORME DU LIT DES RIVIERES A FOND MOBILE.—By L. Fargue. (Part of "Encyclopédie des Travaux Publics," begun by M.-C. Lechalas.) Paris, France: Gauthier-Villars. Paper; 6½ × 10 ins.; pp. 187; 50 illustrations, partly in the text. 9 francs; American price, $2.70.

THE GAS ENGINE.—By Forrest R. Jones. New York: John Wiley & Sons. London, England: Chapman & Hall, Ltd. Cloth; 5¾ × 9¼ ins.; pp. 447; 142 text illustrations and 30 tables. $4; English price, 17s., net.

THE GAS ENGINE.—By Cecil P. Poole, Editor of "Power and the Engineer," Author of "The Wiring Handbook," etc. New York and London: Hill Publishing Co. Cloth; 6 × 9½ ins.; pp. 97; folding tables and 42 text illustrations. $1, net.

DIE GASMASCHINE.—Ihre Entwickelung, Ihre Heutige Bauart und Ihr Kreisprozess. By R. Schöttler, Professor in the Ducal Technical College at Braunschweig. Fifth edition, revised. Berlin, Germany: Julius Springer. Cloth; 7½ × 10½ ins.; pp. 491; 622 illustrations, mostly in the text. 20 marks; American price, $8.

IMPERIAL EARTHQUAKE INVESTIGATION COMMITTEE (Japan).—Bulletin, Vol. II., No. 3. Tokyo, Japan: The Committee. Stiff paper; 7½ × 10¼ ins.; pp. 215 to 228; folding and other plates.

INTERNAL COMBUSTION ENGINES.—Their Theory, Construction and Operation. By Rolla C. Carpenter and H. Diederichs, Professors of Experimental Engineering, Sibley College, Cornell University. Second edition, revised. New York: D. Van Nostrand Co. Cloth; 6 × 9½ ins.; pp. 597; 379 illustrations in the text. $5, net.

THE JOURNAL OF THE IRON AND STEEL INSTITUTE.—Vol. LXXVIII., No. III., 1908. Edited by L. P. Sidney, Assistant Secretary. London, England: E. & F. N. Spon, Ltd. New York: Spon & Chamberlain. Cloth; 5½ × 8¾ ins.; pp. 738; 38 plates.

LABOR LAWS OF THE UNITED STATES.—With Decisions of Courts Relating Thereto. Annual Report

THREE IMPORTANT BOOKS

For Engineer-Constructors

By MILO S. KETCHUM, M. Am. Soc. C. E.
Dean of College of Engineering, University of Colorado

Design of Steel Mill Buildings, Second Edition, 1909
464+xiv Pages; 189 Figures; Specifications; Problems; 15 Tables

Design of Walls, Bins and Grain Elevators, 1907
394+xiv Pages; 260 Figures; 40 Tables; 2 Folding Plates

Design of Highway Bridges, November, 1908
550+xiv Pages; 300 Figures; 77 Tables; 8 Folding Plates

Printed on fine paper and bound uniformly in dark green cloth — Uniform Price, $4.00, net

Prof. Ketchum's books are recognized by engineers as standard and authoritative, and are used as textbooks in more than sixty per cent. of the engineering colleges of the United States.

Every Engineer, Contractor and Designer should have a Complete Set

Complete details from the publishers

THE ENGINEERING NEWS BOOK DEPARTMENT
220 Broadway, New York

NOW READY

BETTERMENT BRIEFS. A Collection of Published Papers on Organized Industrial Efficiency. By H. W. Jacobs. 8vo, 271 pages, 152 figures, mostly half tones. Cloth, $3.50.

CONTENTS—Commercial Tool Methods in Railroad Shops. Improved Devices for Railroad Shops. High-speed Steel in Railroad Shops. Practical Advice to College Men. Organization and Efficiency in the Railway Machine Shop: I. Specializing and Centralizing the Operations and Equipment; II. The General Aspects of Standardization; III. Centralization and Balance of Machine-tool Equipment on an Entire Railroad; IV. Standardization of the Small-tool Equipment; V. Erecting-shop Economies. The Relation between the Mechanical and Store Departments. Shop Efficiency. General Tool System. A. T. & S. F. Ry. Locomotive Repair Costs. The Square Deal to the Railway Employee.

Order through your bookseller, or copies will be forwarded postpaid by the publishers on receipt of the retail price.

JOHN WILEY & SONS
43 and 45 East 19th Street, New York City

PUMPING ENGINES FOR WATER WORKS

BY CHARLES ARTHUR HAGUE

CONTENTS;

CHAPTER I.—The Pumping Station. II.—Historical. III.—Economic Steam Duty. IV.—The Advent of Triple Expansion. V.—The Mariotte Curve. VI.—Steam Jackets. VII.—Coal Duty of Pumping Engines. VIII.—Actual Conditions of Pumping. IX.—The Worthington Duplex Pumping Engine. X.—The Holly Quadruplex Pumping Engine. XI.—The Gaskill Pumping Engine. XII.—The Reynolds Triple Expansion Pumping Engine. XIII.—Various Types and Classes. XIV.—Pumping Engines Adapted to Conditions. XV.—Installation of Pumping Engines. XVI.—Investment Value of Pumping Engines. XVII.—Suction Lift and Suction Pipes. XVIII.—Water Passages and Water Valves. XIX.—The Water Plungers. XX.—Air Chambers. XXI.—Steam Piston. XXII.—Steam Cylinders. XXIII.—Cross Heads. XXIV.—Frames and Bedplates. XXV.—Material for Pumping Engines. XXVI.—Duty Tests of Pumping Engines.

416 Pages. 113 Illustrations. Price, $5.00 net.

PUBLISHED BY

McGRAW PUBLISHING COMPANY
239 West 39th Street (Book Department) NEW YORK

PENNY ENGINEER

Data for Engineers and Draftsmen

On Standard Index Cards, 3 x 5 inches

SERIES No. 4

Strength of Timber Flooring—Strength of Reinforced Concrete Columns and Beams—Strength of 7-8" Rivets, etc.

Price of above Series of 10 Cards 10c., and 2c. for mailing
Circular upon receipt of 2c. postage

PENNY ENGINEER
Room 719, at 167 Dearborn Street, Chicago, Ill.

LEARN RAPID CALCULATION

BY "PRODUCTS OR DIVIDENDS"

Beats any machine. Costs $3. It is a calculating implement in the form of a pocket book. Used and endorsed by office men. For example, one Ry. Co. took a whole edition. This low price precludes extensive advertising; so, by all means, get particulars while you have the address.

G. A. Christensen, C. E., Box 22-N
San Francisco

of the Commissioner of Labor, 1907. (Charles P. Neill, Commissioner.) Washington, D. C.: Pub. Doc. Cloth; 6¼ × 9¼ ins.; pp. 1,562.

THE [illegible] STORY OF SIR CHARLES TILSTON BRIGHT, CIVIL ENGINEER.—With Which Is Incorporated the Story of the Atlantic Cable, and the First Telegraph to India and the Colonies. (Revised and abridged edition.) By Charles Bright, F. [illegible] E., Author of "Submarine Telegraphs," etc. London, England: Archibald Constable & Co., Ltd. Cloth; 6 × 8¾ ins.; pp. 478; numerous illustrations in the text. 12s. 6d., net; American price, $5.

THE MANUFACTURE OF EXPLOSIVES.—Twenty Years' Progress. Four Cantor Lectures Delivered at the Royal Society of Arts in November and December, 1906. By Oscar Guttmann, M. Inst. C. E. London and New York: Whittaker & Co. Cloth; 6 × 9 ins.; pp. [illegible] nine plates. $1.10, net.

THE "MECHANICAL WORLD" ELECTRICAL POCKET BOOK FOR 1909.—Containing a Collection of Electrical Engineering Notes, Rules, Tables and Data. Manchester, England: Emmott & Co., Ltd. Cloth; 4 × 6¾ ins.; pp. 208; 60 illustrations in the text. 6d., net.

THE MUNICIPAL ECONOMIST.—A Monthly Magazine Devoted to Public Works and Municipal Affairs. Vol. I., No. 2, February, 1909. Chicago, Ill.: The Municipal Information Bureau. Paper; 7¾ × 10½ ins.; pp. 60. Illustrated. $5 per year.

NATIONAL FIRE PROTECTION ASSOCIATION.—Index to Subjects Covered in the Printed Records. Chicago, Ill.: The Secretary (382 Ohio St.). Stiff paper; 5¾ × 9 ins.; pp. 47.

THE NEUTRAL LINE.—A Plea for Scientific Regulation of the Tariff. Address to the National Tariff Commission Convention at Indianapolis, Feb. 16-18, 1909. By Henry R. Towne, President Merchants' Association of New York. New York: The Merchants' Association. Paper; 6 × 9 ins.; pp. 32.

NEW JERSEY SANITARY ASSOCIATION.—Proceedings of the Annual Meeting Held Dec. 4-5, 1908, at Lakewood, N. J. (James A. Exton, M. D., Arlington, N. J., Secy.). Trenton, N. J.: Pub. Doc. Stiff paper; 5¾ × 9 ins.; pp. 137.

NEW METHODS IN BACKWATER COMPUTATIONS.—By B. F. Groat, Professor of Mechanics, School of Mines, University of Minnesota. (Reprint from "The Minnesota Engineer," January, 1909, Vol. XVII., No. 2.) Paper; 6¾ × 10 ins.; pp. 15; five illustrations in the text.

A PHILIPPINE SUBSTITUTE FOR LIGNUM VITAE.—By W. I. Hutchinson, Forester. Bulletin No. 9, Bureau of Forestry; Major George P. Ahern, Director. Manila, P. I.: Pub. Doc. Paper; 5¾ × 9 ins.; pp. 8.

THE PORT OF PORTLAND COMMISSION.—Biennial Report to the 25th Regular Session of the Legislative Assembly of the State of Oregon, 1907-1908. (J. B. C. Lockwood, M. Am. Soc. C. E., Chief Engineer.) Paper; 6 × 9 ins.; pp. 68; three plates, one folding map and numerous tables.

PROFESSIONAL PAPERS, U. S. GEOLOGICAL SURVEY.—George Otis Smith, Director. Washington, D. C.: Pub. Doc. Paper; 9 × 11½ ins.

No. 61: Glaciation of the Uinta and Wasatch Mountains. By Wallace W. Atwood. Pp. 96; 15 plates (1 in pocket) and 24 text illustrations.

THE PUBLIC UTILITY COMMISSION OF NEW YORK CITY.—From "The City Club Bulletin," Vol. II., No. 21, Jan. 20, 1909. Chicago, Ill.: The City Club (228 South Clark St.). Paper; 6¾ × 10¼ ins.; pp. 235 to 250.

PUBLIC WORKS DEPARTMENT (South Australia).—Report for the Year Ending June 30, 1907. (Thomas Price, Commissioner of Public Works.) Adelaide, South Australia: Pub. Doc. Paper; 8½ × 13¼ ins.; pp. 101; folding and other plates.

THE RAILWAY LOCOMOTIVE.—What It Is and Why It Is What It Is. By Vaughan Pendred, M. Inst. M. E. New York: D. Van Nostrand Co. Cloth; 5½ × 8½ ins.; pp. 310; 94 illustrations in the text. $2, net.

REFUSE AND GARBAGE DISPOSAL.—References to Books and Magazine Articles. (Reprinted from the Monthly Bulletin, January, 1909.) Pittsburg, Pa.: Carnegie Library. Paper; 6 × 9 ins.; pp. 39. 5 cts.

SHIPPING AND OVERSEA MIGRATION.—Commonwealth of Australia, 1907. Published under the Authority of the Minister of Home Affairs, by G. H. Knibbs, Commonwealth Statistician. Melbourne, Australia: Pub. Doc. Stiff paper; 8 × 12¾ ins.; pp. 99.

A SHORT HAND-BOOK OF OIL ANALYSIS.—By Augustus H. Gill, Ph. D., Associate Professor of Technical Analysis at the Massachusetts Institute of Technology, Boston, Mass., Author of "Gas and Fuel Analysis for Engineers," etc. Fifth edition, revised and enlarged. Philadelphia and London: J. B. Lippincott Co. Cloth; 5¼ × 8¼ ins.; pp. 179; six illustrations in the text. $2, net.

THE SOCIOLOGIC ASPECTS OF TYPHOID FEVER.—Carroll E. Edson, A. M., M. D. (Proceedings of the Colorado Scientific Society, Vol. IX.) Denver, Colo.: The Society. Paper; 6 × 9½ ins.; pp. 113 + 133; six text illustrations.

STATE BOARD OF IRRIGATION (Nebraska).—Biennial Report of the State Engineer, Secretary to the Governor, 1907-1908. (Adna Dobson, State Engineer, Secy.) Lincoln, Neb.: Pub. Doc. Cloth; 5¾ × 9 ins.; pp. 186; 13 plates.

STATE ENGINEER (Colorado).—Biennial Report to the Governor for the Years 1907-1908. (Thomas W. Jaycox, State Engineer.) Denver, Colo.: Pub. Doc. Paper; 6 × 9 ins.; pp. 281; numerous folding and other plates; maps and bridge drawings in separate pamphlet.

STATE FORESTER (California).—Second Biennial Report. (G. B. Lull, State Forester.) Sacramento, Cal.: Pub. Doc. Paper; 5¾ × 9 ins.; pp 33; folding plates and text illustrations.

STRENGTH OF MATERIALS.—By Arthur Morley, M. Inst. M. E., Professor of Mechanical Engineering in University College, Nottingham. London, New York and Bombay: Longmans, Green & Co. Cloth; 5½ × 8¾ ins.; pp. 487; 244 illustrations in the text. $2.50, net; English price, 7s. 6d., net.

TABLES OF ARTESIAN BORINGS, PERENNIAL SPRINGS, AND WATER ANALYSES (Queensland).—Known to the Water Supply Department at the End of December, 1907. With Accompanying Map Showing Approximately Their Respective Positions; also, Geological Data. Compiled by the Direction of J. B. Henderson, M. Inst. C. E., M. Am. Soc. C. E., Government Hydraulic Engineer. Brisbane, Queensland: Pub. Doc. Paper; 8½ × 13¼ ins.; pp. 56; folding and other plates.

THEORY AND CALCULATION OF TRANSIENT ELECTRIC PHENOMENA AND OSCILLATIONS.—By Charles Proteus Steinmetz. New York: McGraw Publishing Co. Cloth; 6 × 9½ ins.; pp. 556; 102 illustrations in the text. $5, net.

VECTORS AND VECTOR DIAGRAMS.—Applied to the Alternating Current Circuit. With Examples of Their Use in the Theory of Transformers, and of Single and Polyphase Motors, etc. By William Cramp, Consulting Engineer and Special Lecturer in Electrical Design in the University of Manchester, and Charles F. Smith, Assoc. M. Inst. C. E., Lecturer in Electrical Engineering, The University of Manchester, and Director of the Electrical Engineering Laboratories, Municipal School of Technology, Manchester. London, New York and Bombay: Longmans, Green & Co. Cloth; 5½ × 8¾ ins.; pp. 252; 114 illustrations, mostly in the text. $2.50, net.

WATER-SUPPLY PAPERS, U. S. GEOLOGICAL SURVEY.—George Otis Smith, Director. Washington, D. C.: Pub. Doc. Paper; 5¾ × 9¼ ins.

No. 221: Geology and Water Resources of the Great Falls Region, Montana. By Cassius A. Fisher. Pp. 89; seven plates (one in pocket).

No. 225: Ground Waters of the Indio Region, California, with a Sketch of the Colorado Desert. By Walter C. Mendenhall. Pp. 56; twelve plates (two in pocket) and five text figures.

WEIGHT, SIZE AND CONDITION OF 14-IN. PIPE MAIN.—Laid for the City of Vallejo, Cal. Report of Otto von Geldern, Consulting Engineer. Vallejo, Cal.: Board of City Trustees. Paper; 4½ × 6 ins.; pp. 24.

ROAD CONSTRUCTION AND MAINTENANCE

City Roads and Pavements. By WILLIAM PIERSON JUDSON, M. Am. Soc. C. E.
Suited for Cities of Moderate Size. Fourth Edition, Revised (1909) Just Published
Cloth; 6x9 inches; 197 pages; 69 illustrations. Price, $2.00, net.

This book fills the need for a short, concise treatise on the present practice among cities relative to the laying of pavements, what kinds of pavements are most favored, and how different kinds of paving materials are wearing. It treats this broad subject concisely and liberally, giving well illustrated and up-to-date descriptions of the various kinds of pavements in practical use, with costs of laying and maintenance, and many statistics for cities and localities all over the United States, and references to European practice and experience.

Road Preservation and Dust Prevention. By WM. PIERSON JUDSON, M. Am. Soc. C. E.
Cloth; 6x9 inches; 144 pages; 16 illustrations. Price, $1.50, net.

In this book are given the results of investigations and experiments made during the past four years in the problems of Road Dust—Its Control and Prevention; Moisture; Oil Emulsions; Oils; Coal-Tar Preparations; Tar-Spraying Machines; Tar-Macadam; Rock Asphalt Macadam; Bitulithic Pavements, with methods, costs, results, tests, etc. A Necessary and Timely Book for Every Engineer.

Economics of Road Construction. By H. P. GILLETTE.
Second Edition. Cloth; 6x9 inches; 48 pages; 9 illustrations. Price, $1.00, net.

Contents:—Historical Review.—Earth Roads and Earthwork; Profile of Cross-Section of Road; Longitudinal Profile, Gutters and Drains, Embankments, Cost of Earthwork, Surfacing, Traction and Tractive Power, Location, Gravel Roads—Macadam Roads: What Holds Macadam Together, Quality of Stone; Quarrying, Dynamite, Crushing, Hauling, Spreading, Rolling, Sprinkling, Quality and Cost, Telford Roads, Repairs and Maintenance, Suggested Improvements in Road Specifications, Summary

Specifications for Street Roadway Pavements. By S. WHINERY, M. Am. Soc. C. E.
Paper; 6x9 inches; 56 pages. Price, 50 cents, net.

These specifications have been prepared by one of the foremost authorities on road construction, and embody the results of extended experience and expert observation. Every city engineer, consultant and contractor having to deal with urban highway improvements will find this work of inestimable value, and should lose no time in procuring a copy.

Modern Methods of Street Cleaning. By DR. GEO. A. SOPER. *In Preparation.*

The Engineering News Book Department
220 BROADWAY NEW YORK

TEN GOOD BOOKS
For RAILROAD MEN

RAILWAY TRACK and TRACKWORK
By E. E. R. Tratman
A. M. Am. Soc. C. E.

Third Edition, Fully Revised and Enlarged.
Cloth; 6 × 9 ins.; 472 pp.; 226 illus.....$3.50

ECONOMICS OF RAILWAY OPERATION
By M. L. Byers
Ch. Eng. M. W., Missouri Pac. Ry.

Buckram; 6 × 9 ins.; 672 pp.; many figures, diagrams and forms illustrating the best modern practice.....$5.00

The General Objects of the "Economics of Railway Operation" are:

(1) To so outline the operations of each department as to give to those not familiar with its workings a sufficient insight to enable them readily to acquire further detailed information through their own observations, and through their ability to inquire intelligently in regard to those features which they do not understand.

(2) To bring into clear relief the underlying principles of economic operation with a view to the practical usefulness of this information to the employee in securing better results in that portion of the field under his direction; also to give him a clearer general understanding of the science of railroading and so fit him for further promotion. In order to make the information available to as many as possible, the use of mathematics and technicalities has been avoided to the utmost.

FIELD PRACTICE OF RAILWAY LOCATION
By Willard Beahan

Cloth; 6 × 9 ins.; 260 + x pp.; 43 illustrations and 7 folding plates.....$3.00

THE SIX CHORD SPIRAL
By J. R. Stephens, C. E.

5 × 7½ ins.; 76 pp.; 6 figures; 8 tables.
Boards $1.00
Cloth $1.25

Describes the methods of employing this new form of railway transition curve, which is universally adaptable, and can be readily applied by transitmen having no previous knowledge of spirals.

RAILROAD CURVE TABLES
By R. S. Henderson

5 × 7 ins.; 69 pp.; 10 diagrams.
Cloth $1.00
Flexible leather.....$1.50

Containing a comprehensive table of functions of a one-degree curve, with correction quantities giving exact values for any degree of curve; also trigonometric tables and formulas, and a method of finding any function of a curve, of any degree or radius, without a field book.

RAILWAY LOCATION AND CONSTRUCTION
By E. N. McHenry

Cloth; 4½ × 7½ ins.; 88 pp.; 2 folding plates $1.00

Containing chapters on organization of Construction and Engineering Departments, Location of Line, Surveys and Construction, Track and Ballast, Bridges and Culverts, Accounting and Miscellaneous, Supplies and Equipment for Field Parties, etc., with an additional chapter on "Estimating Overhaul in Earthwork," by H. P. Gillette.

RAILWAY RIGHT OF WAY SURVEYING
By A. I. Frye

Cloth; 6 × 9 ins.; 50 pp.....$1.00

TYPICAL STEEL RAILWAY BRIDGES
By W. Chase Thomson
M. Can. Soc. C. E.

Cloth; 6 × 9 ins.; vii. + 178 pp.; 21 diagrams and detail drawings (including 5 folding plates) $2.00

This work has been developed from a series of lectures given under the auspices of the Dominion Bridge Company. The structures chosen for treatment represent the types of railway bridges most generally in use, and have been selected because they are best suited to illustrate the problems which present themselves most frequently to the bridge designer. They include the following: a 60-ft. Deck Plate Girder, a 100-ft. Deck Warren Girder, a 150-ft. Through Pratt Truss, a 200-ft. Through Pratt Truss with curved top chord, a 170-ft. Swing Bridge and a Railway Viaduct.

THE RAILWAY TRANSITION SPIRAL
By Prof. A. N. Talbot

Flexible leather; 4 × 6¾ ins.; 102 + vi. pp.; including 17 pages of tables; Fifth Edition, Revised.....$1.50

MODERN TUNNEL PRACTICE
By D. McN. Stauffer
M. Am. Soc. C. E.

Cloth; 6¼ × 9½ ins.; 314 pp.; 138 illus....$3.50

Contents: Tunnel Location and Surveying; Explosives; Blasting; Notes on Shaft Sinking; Principles of Tunnel Timbering and Driving; Tunnel Arch Centers; Subaqueous Tunnels and Tunnel Shields; Subways, or Underground Railways; Special Tunnel Building Plant; Some Data upon the Cost of Tunneling; Ventilation of Tunnels; Air-Locks; Tunnel Notes; Construction of the Simplon Tunnel—Water-Works Tunnel in Cincinnati, O.—Telephone and Freight Transportation Tunnels in Chicago. APPENDIX—Glossary of some of the more unusual terms used in Tunneling.

Complete details from
THE ENG. NEWS BOOK DEPT. 220 Broadway New York
Publishers and Booksellers

REFERENCE BOOKS FOR STRUCTURAL ENGINEERS

SMOLEY'S TABLES, by C. Smoley.
(Fifth Edition—Revised and Enlarged)
Flexible Leather; 5 x 7 ins.; x + 472 pp.....$3.50
Log-trigonometric Tables, separate; iii + 472 pp. 1.50
Parallel Tables of Logarithms and Squares from 0 to 100 feet, Angles and Logarithmic Functions Corresponding to Given Bevels, to which is added a Multiplication Table of Rivet Spacing and a complete set of 5-Decimal Logarithmic-trigonometric Tables for Engineers, Architects and Students.

BATTER TABLES, by C. G. Wrentmore, C.E.
Buckram; 8 x 10 ins.; 192 pp.....$5.00
Tables for 192 Batters from 1/16-in., 1/8-in., 1/16-in., to 12 ins. per ft., giving Altitude and Hypothenuse in Feet and Decimals of Feet for any Base Measured in Feet, Inches and Sixteenths. With a Table of Equivalents of Inches and Fractions in Decimals of a Foot. A useful set of tables for the structural drafting room, saving much time in detailing.

TABLES OF LOGARITHMS OF LENGTHS UP TO 50 FEET, VARYING BY 1-16 OF AN INCH, by Thos. W. Marshall.
Flexible Morocco; oblong; 5¾ x 3½ ins....$2.00

ANALYSIS OF ELASTIC ARCHES, by J. W. Balet.
Cloth; 6 x 9 ins.; 320 pages; 184 diagrams; 6 folding plates; 19 tables.....$3.00
This book has been prepared for the purpose of bringing to the aid of practicing engineers an exact, simple and reliable method for computing the stresses in arches, according to the elastic theory.

EDGE'S WEIGHT COMPUTER FOR STRUCTURAL SHAPES.
A thoroughly modern labor-saving appliance at small cost. Will calculate the weight of all structural shapes of any length, quickly, accurately, without multiplication or reference to books or tables and with great simplicity.....$2.00

Complete details from
THE ENGINEERING NEWS BOOK DEPT.
Publishers and Booksellers
220 BROADWAY, - - NEW YORK

The Most Valuable Book Ever Published for Engineering-Contractors and Workers in Concrete

CONCRETE SYSTEM

By FRANK B. GILBRETH, M. Am. Soc. C. E.

This concrete system is *not* a theoretical treatise—it is a thoroughly and intensely practical book, containing the written ideas of the most successful men in the organization of one of the most successful of American contractors, and tells *how to do the work*, Economically, Expeditiously, Systematically and Safely.
Contains 220 illustrations and 10 folding plates, printed on fine coated paper and bound in full flexible morocco.
PRICE, $5.00 NET
EVERY CONTRACTOR should have a copy—ORDER NOW.
Descriptive circular on request
The Engineering News Book Dept.
220 Broadway, New York

Just Published

ROAD PRESERVATION AND DUST PREVENTION

By WILLIAM PIERSON JUDSON
M. Am. Soc. C. E.; M. Inst. C. E.
Author of "City Roads and Pavements"

THE preservation of surface and the prevention of dust on macadamized roads are matters which are most urgent, and road builders have been for some years working and experimenting to these ends, with results which are here for the first time compiled in book form.
Gives methods, costs, results, tests, etc.
A necessary and timely book for every engineer.
Cloth; 6 x 9 inches; 144 pages; 16 illustrations.
Price, $1.50, net.
Descriptive circular on request.
The Engineering News Book Dept.
220 Broadway, New York

D. Van Nostrand Company's New Publications

12mo, cloth, 68 pages, 15 illustrations.
$2.00 net
Water Hammer in Hydraulic Pipe Lines
With a chapter on the
Speed Regulation of Hydraulic Turbines
By A. H. GIBSON, M. Sc., Assoc. M. I. C. E.

8vo, cloth, 757 pages, 310 illustrations.
Price, **$5.00 net**
Hydraulics and Its Applications
By A. H. GIBSON, M. Sc., Assoc. M. I. C. E.

4⅞ ins. x 6½ ins., cloth, 290 pages, 113 illustrations. Price, **$2.50 net.**
Manual of Reinforced Concrete and Concrete Block Construction
By CHAS. F. MARSH & WM. DUNN.

8vo, cloth, 136 pages, 75 illustrations.
Price, **$2.00 net.**
Graphical Determination of Earth Slopes, Retaining Walls and Dams
By CHARLES PRELINI, Professor of Civil Engineering, Manhattan College, New York City.

2¾ ins. thick, cloth, 517 8 x 11 in. pages.
$10.00 net.
41 Tables, 500 Illustrations, 63 Plates.
Cranes
Their Construction, Mechanical Equipment and Working
By ANTON BOTTCHER.
Translated and Supplemented with AMERICAN, English and Continental Practice.
By A. TOLHAUSEN, C. E.

8vo, cloth, 400 pages, 236 illustrations.
$6.00 net.
The Practical Design of Irrigation Works
Setting forth the principle governing the design, in a detailed as well as a general aspect.
By B. BLIGH.

8vo, cloth, 301 pages, illustrated. **$5.00 net.**
Irrigation
Its principles and practice as a branch of engineering. By Sir HANBURY BROWN, K. C. M. G., Member of the Institution of Civil Engineers (late Royal Engineers).

D. VAN NOSTRAND CO.
Publishers and Booksellers
23 Murray and 27 Warren Streets, N.Y.

FOURTH THOUSAND NOW READY
Turneaure and Maurer Principles of Reinforced Concrete Construction
8vo, viii + 317 pages, 11 plates and 130 figures. Cloth, $3.00

EIGHTH THOUSAND NOW READY
Taylor and Thompson's Treatise on Concrete Plain and Reinforced
8vo, Cloth, $5.00.

FIFTEENTH EDITION, REVISED, TOTAL ISSUE, THIRTY-FIVE THOUSAND
Kidder's Architects' and Builders' Pocket Book
16mo, xix + 1703 pages, 1000 figures
Morocco, $5.00
Chapters on Fireproofing and Reinforced Concrete Rewritten by RUDOLPH P. MILLER, C. E.
Section on Paint Rewritten by ALVAH H. SABIN

EIGHTEENTH EDITION NINETY-FOURTH THOUSAND
Trautwine's Civil Engineers' Pocket Book
$5.00.

TOTAL ISSUE, 60,000
Kent's Mechanical Engineers' Pocket Book
16mo, morocco, $5.00.

TOTAL ISSUE, 40,000
Searles' Field Engineering
16mo, morocco, $3.00.

JOHN WILEY & SONS
SCIENTIFIC PUBLISHERS
43 and 45 East 19th St., New York City